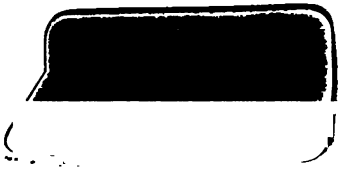

THE SCIENCE AND ART

OF

ARITHMETIC;

For the Use of Schools.

EXERCISE BOOK. PARTS II. & III.

BY

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AND

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"The mills of God grind slowly, but they grind exceedingly small."

LONDON:

WHITTAKER AND CO.

1877.

EXERCISE BOOK. PART II.

Exercise I.

Find one-half, one-third, one-quarter, one-fifth, one-sixth, one-seventh, one-eighth, one-ninth, one-tenth, one-eleventh and one-twelfth of £57. 15*s.*

Exercise II.

		£.	*s.*	*d.*			£.	*s.*	*d.*
Find (1)	$\frac{2}{3}$ of	197	15	$4\frac{1}{2}$	Find (7)	$\frac{4}{9}$ of	8043	17	3
(2)	$\frac{3}{4}$ of	1037	17	6	(8)	$\frac{7}{10}$ of	27419	12	$8\frac{1}{2}$
(3)	$\frac{2}{5}$ of	23	7	$9\frac{3}{4}$	(9)	$\frac{5}{11}$ of	489	18	$11\frac{1}{4}$
(4)	$\frac{5}{6}$ of	1001	15	0	(10)	$\frac{11}{12}$ of	3584	16	3
(5)	$\frac{3}{7}$ of	893	1	$9\frac{3}{4}$	(11)	$\frac{7}{15}$ of	23	7	$9\frac{3}{4}$
(6)	$\frac{5}{8}$ of	347	13	6	(12)	$\frac{11}{18}$ of	65	17	9

Exercise III.

(1) Find the length of $\frac{4}{5}$ of a mile.

(2) Divide $\frac{7}{11}$ of a mile into 8 equal parts.

(3) Find $\frac{4}{7}$ of a ton.

(4) Find $\frac{3}{8}$ of 1 lb. troy.

(5) Find the value of £$\frac{4}{5}$ + £$\frac{2}{3}$ + $\frac{5}{6}$ of 1*s.*

(6) Find the value of $\frac{2}{3}$ of a guinea + £$\frac{1}{3}$ − $\frac{3}{4}$ of 1*d.*

(7) Distribute $\frac{5}{7}$ of 1 cwt. of coals among four persons.

(8) Divide the distance of $\frac{5}{11}$ of 7 miles into 8 equal portions.

(9) If I spend $\frac{2}{3}$ of a guinea per day, how much is that in 10 days?

(10) Find the value of the whole amount, if $\frac{4}{5}$ of it is £429. 6*s.* 8*d.*

(11) Find the value of £$\frac{1}{2}$, £$\frac{1}{3}$, £$\frac{2}{3}$, £$\frac{1}{4}$, £$\frac{3}{4}$, £$\frac{1}{5}$, £$\frac{2}{5}$, £$\frac{3}{5}$, £$\frac{4}{5}$, £$\frac{1}{6}$, £$\frac{5}{6}$, £$\frac{1}{8}$, £$\frac{3}{8}$, £$\frac{5}{8}$, £$\frac{7}{8}$, £$\frac{1}{10}$, £$\frac{1}{12}$, £$\frac{1}{15}$, £$\frac{1}{16}$, £$\frac{1}{20}$.

(12) Find the value of $\frac{1}{2}$ of 1*s.*, $\frac{1}{3}$ of 1*s.*, $\frac{2}{3}$ of 1*s.*, $\frac{1}{4}$ of 1*s.*, $\frac{3}{4}$ of 1*s.*, $\frac{1}{6}$ of 1*s.*, $\frac{5}{6}$ of 1*s.*, $\frac{1}{8}$ of 1*s.*, $\frac{3}{8}$ of 1*s.*, $\frac{5}{8}$ of 1*s.*, $\frac{7}{8}$ of 1*s.*, $\frac{1}{12}$ of 1*s.*

EXERCISE IV.

Reduce to improper fractions:

(1) $2\frac{1}{2}$.	(6) $84\frac{17}{20}$.	(11) $41\frac{583}{1000}$.	(16) $5000\frac{83}{1000}$.
(2) $3\frac{1}{2}$.	(7) $864\frac{13}{97}$.	(12) $41\frac{83}{1000}$.	(17) $100\frac{28}{33}$.
(3) $7\frac{2}{3}$.	(8) $46\frac{7}{10}$.	(13) $41\frac{3}{1000}$.	(18) $10000\frac{14}{15}$.
(4) $8\frac{3}{4}$.	(9) $46\frac{17}{100}$.	(14) $41\frac{3}{10000}$.	(19) $3001\frac{83}{700}$
(5) $12\frac{13}{15}$.	(10) $46\frac{7}{100}$.	(15) $400\frac{127}{400}$.	(20) $73\frac{72}{99}$.

EXERCISE V.

Reduce to whole or mixed numbers:

(1) $\frac{19}{2}$.	(6) $\frac{529}{23}$.	(11) $\frac{158}{10}$.	(16) $\frac{648597}{10}$.
(2) $\frac{43}{3}$.	(7) $\frac{419}{21}$.	(12) $\frac{519}{10}$.	(17) $\frac{648597}{100}$.
(3) $\frac{59}{4}$.	(8) $\frac{584}{17}$.	(13) $\frac{8431}{10}$.	(18) $\frac{648597}{1000}$.
(4) $\frac{50}{5}$.	(9) $\frac{3519}{467}$.	(14) $\frac{12594}{10}$.	(19) $\frac{648597}{10000}$.
(5) $\frac{137}{5}$.	(10) $\frac{37}{10}$.	(15) $\frac{300000}{10}$.	(20) $\frac{648597}{100000}$.

EXERCISE VI.

(1) $2\frac{1}{2} + 3\frac{1}{2} + 5\frac{1}{2}$.
(2) $8\frac{1}{3} + 7\frac{1}{3} + 15\frac{2}{3} + 1\frac{1}{3}$.
(3) $42\frac{3}{4} + 58\frac{2}{4} + 3\frac{1}{4} + 19\frac{3}{4} + 11\frac{1}{4}$.
(4) $73\frac{4}{5} + 5\frac{2}{5} + 7\frac{1}{5} + 184\frac{3}{5} + 2049\frac{2}{5}$.
(5) $5\frac{13}{17} + 8\frac{16}{17} + 12\frac{11}{17} + 1\frac{9}{17}$.
(6) $3\frac{5}{12} + 52\frac{7}{12} + 87\frac{1}{12} + 943\frac{11}{12}$.
(7) $278\frac{15}{28} - 189$.
(8) $278\frac{15}{28} - 189\frac{15}{28}$.
(9) $278\frac{15}{28} - 189\frac{11}{28}$.
(10) $278 - 189\frac{11}{28}$.
(11) $278\frac{11}{28} - 189\frac{15}{28}$.
(12) $52\frac{3}{10} + 86\frac{1}{10} + 42\frac{9}{10} + 5\frac{7}{10} + 84\frac{3}{10}$.
(13) $584\frac{37}{100} + 129\frac{9}{100} + 43\frac{27}{100} + 3\frac{93}{100} + 4\frac{87}{100} + 1\frac{99}{100} + 6\frac{7}{100}$.
(14) $1\frac{11}{100} + 6\frac{48}{100} + 11\frac{85}{100} + 17\frac{22}{100} + 22\frac{59}{100} + 27\frac{96}{100}$.
(15) $2\frac{43}{1000} + 3\frac{154}{1000} + 4\frac{265}{1000} + 5\frac{376}{1000} + 6\frac{487}{1000} + 7\frac{598}{1000} + 8\frac{709}{1000} + 1\frac{1}{1000}$.
(16) $2012\frac{16}{19} - 789$.

(17) $2012\frac{16}{19} - 789\frac{12}{19}$.
(18) $2012\frac{16}{19} - 789\frac{16}{19}$.
(19) $2012 - 789\frac{12}{19}$.
(20) $2012\frac{12}{19} - 789\frac{18}{19}$.
(21) $34\frac{17}{23} + 18\frac{11}{23} + 49\frac{16}{23} + 519\frac{20}{23} + \frac{21}{23}$.
(22) $4301\frac{10}{11} - 896$.
(23) $4301\frac{10}{11} - 896\frac{4}{11}$.
(24) $4301 - 896\frac{4}{11}$.
(25) $4301\frac{4}{11} - 896\frac{10}{11}$.
(26) $100\frac{4}{11} - (12\frac{7}{11} + 16\frac{8}{11} + 20\frac{9}{11} + 24\frac{10}{11})$.
(27) $(14\frac{3}{17} + 16\frac{8}{17} + 18\frac{13}{17} + 21\frac{1}{17} + 23\frac{6}{17}) - 10\frac{16}{17}$.
(28) $(5\frac{8}{100} + 11\frac{61}{100} + 18\frac{14}{100} + 24\frac{67}{100} + 31\frac{20}{100} + 37\frac{73}{100}) - (1\frac{1}{100} + 7\frac{54}{100} + 14\frac{7}{100} + 20\frac{60}{100} + 27\frac{13}{100} + 33\frac{66}{100})$.
(29) $(538\frac{123}{500} + 169\frac{329}{500}) + (538\frac{123}{500} - 169\frac{329}{500})$.
(30) $(538\frac{123}{500} + 169\frac{329}{500}) - (538\frac{123}{500} - 169\frac{329}{500})$.
(31) $\frac{16}{19} + \frac{16}{19} + \frac{16}{19} + \frac{16}{19} + \frac{16}{19}$.
(32) $7\frac{13}{25} + 7\frac{13}{25} + 7\frac{13}{25} + 7\frac{13}{25} + 7\frac{13}{25} + 7\frac{13}{25} + 7\frac{13}{25}$.
(33) $8\frac{4}{5} + 8\frac{4}{5} + 8\frac{4}{5} + 8\frac{4}{5} + 8\frac{4}{5}$.

EXERCISE VII.

(1) $\frac{7}{18} \times 2, 3, 4, 5, 6, 7, 8, 9$.
(2) $\frac{11}{60} \times 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 20$.
(3) $\frac{59}{144} \times 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 16, 18, 24, 36, 72$.
(4) $\frac{43}{100} \times 2, 3, 4, 5, 7, 9, 10, 20, 25, 30, 50$.
(5) $\frac{113}{240} \times 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 20, 30, 40, 50, 60, 70, 80, 100, 120$.
(6) $4\frac{1}{2} \times 2, 3, 4, 5, 6, 7, 8, 9, 10$.
(7) $11\frac{11}{30} \times 2, 3, 4, 5, 6, 7, 8, 9, 10$.
(8) $118\frac{419}{1000} \times 2, 4, 5, 7, 11, 20, 24, 25, 100, 500$.
(9) What will 9 men pay for their dinner, if each pays $\frac{3}{4}$ of a crown?
(10) If 1 horse eats $\frac{7}{8}$ of a load, what will 4 horses eat?
(11) If I consume $2\frac{5}{12}$ bushels a-week, how much shall I consume in 7 weeks? Also in 4 weeks?
(12) What will be paid for 6 articles at £$1\frac{11}{18}$ each?

EXERCISE VIII.

(1) $\frac{15}{16} \div 2, 3, 4, 5, 6, 7, 8.$
(2) $\frac{20}{21} \div 2, 3, 4, 5, 6, 7, 10.$
(3) $\frac{100}{107} \div 2, 3, 4, 5, 6, 10, 20, 100.$
(4) $5\frac{1}{4} \div 2, 3, 4, 5, 7, 10.$
(5) $38\frac{2}{5} \div 2, 3, 4, 5, 6, 7, 8, 12, 20.$
(6) $1423\frac{1}{17} \div 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12.$

EXERCISE IX.

(1) $\frac{144}{175} \times 2, 3, 4, 5, 6, 7, 8, 25, 35, 175.$
$\div 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 16, 18, 72.$
(2) $8\frac{74}{77} \times 2, 3, 4, 7, 11, 12, 77.$
$\div 2, 3, 4, 5, 6, 7, 10, 23, 230.$
(3) Find $\frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \frac{1}{5}, \frac{1}{6}, \frac{1}{7}, \frac{1}{8}, \frac{1}{9}, \frac{1}{10}$ of $\frac{12}{13}$.
(4) Find $\frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \frac{1}{5}, \frac{1}{6}, \frac{1}{7}, \frac{1}{8}, \frac{1}{9}, \frac{1}{10}$ of $860\frac{8}{11}$.

(5) A Hanoverian mile is $4\frac{13}{22}$ English miles nearly. Find the length in English miles of 11 Hanoverian miles.

(6) Find $\frac{2}{3}, \frac{3}{4}, \frac{3}{5}, \frac{5}{8}, \frac{7}{9}, \frac{7}{10}$ of $2522\frac{31}{72}$.

(7) How long will $13\frac{2}{7}$ pieces be, if 3 are $8\frac{2}{5}$ yards in length?

(8) Distribute $9\frac{1}{3}$ cwt. of potatoes among 7 families of 5 persons each. How much will be given to each family, and how much to each person?

(9) If 1 person consumes $\frac{4}{15}$ of a lb. a-day, how much will a family of 5 persons consume in a week?

(10) Find the average of the following lengths: $1\frac{4}{11}$ yds., $1\frac{6}{11}$ yds., $1\frac{7}{11}$ yds., $\frac{10}{11}$ yds., $1\frac{9}{11}$ yds.

(11) I empty into a vat 2 vessels of $4\frac{5}{7}$ gallons each, 3 vessels of $2\frac{6}{7}$ gals. each, 7 vessels of $1\frac{4}{7}$ gals. each, 5 vessels of $4\frac{1}{7}$ gals. each. Distribute the contents of the vat into 2 equal vessels; also into 3, 4, 5, 7, 12, and 29 equal vessels.

(12) If I walk $3\frac{5}{6}$ miles an hour, how far shall I walk in 2, 3, 4, 5, 6 hours?

EXERCISE X.

(1) $\frac{5}{13} \times 13$.

(2) $\frac{19}{23} \times 23$.

(3) $\frac{2485}{9711} \times 9711$.

(4) $6\frac{4}{5} \times 5$.

(5) $10\frac{7}{19} \times 19$.

(6) $463\frac{61}{62} \times 62$.

(7) $8\frac{4}{7} \times 7, 14, 21$.

(8) $10\frac{5}{12} \times 24, 36, 60$.

EXERCISE XI.

(1) $76\frac{12}{23} \div \frac{1}{23}, \frac{2}{23}, \frac{4}{23}, \frac{5}{23}, \frac{8}{23}, \frac{11}{23}, \frac{16}{23}$.

(2) $76\frac{12}{23} \div 3\frac{11}{23}, 4\frac{18}{23}, 7\frac{15}{23}, 19\frac{3}{23}$.

(3) If a wheel is $2\frac{6}{7}$ feet in circumference, how many turns will it make in travelling over $17\frac{1}{7}$ feet?

(4) How many times is $\frac{5}{17}$ contained in $4\frac{12}{17}$?

(5) To how many people can I give $\frac{11}{21}$ of a load each out of $5\frac{5}{21}$ loads?

EXERCISE XII.

(1) If I consume $2\frac{5}{8}$ bushels in one week, how much shall I consume in 3 days; also in a quarter of a day?

(2) Divide $3417\frac{4}{9}$ by 45.

(3) If I spend alternately £$\frac{2}{7}$ and £$\frac{3}{7}$ in a day, how much shall I spend in 14 days, and how long will £$8\frac{4}{7}$ last me?

(4) Find the value of $\frac{11}{14}$ of a guinea $+ \frac{3}{8}$ of a shilling $- \frac{5}{6}$ of 9*d*.

(5) Find the value of $\frac{13}{27}$ of £209. 11*s*. $2\frac{1}{4}$*d*.

(6) $2\frac{26}{35} \times 2, 3, 4, 5, 6, 7, 8, 9, 10, 35$.

(7) $2\frac{26}{35} \div 2, 3, 4, 5, 6, 7, 8, 9, 10$.

(8) $2\frac{26}{35} \div \frac{1}{35}, \frac{8}{35}, \frac{24}{35}, 1\frac{13}{35}$.

(9) If $\frac{5}{7}$ of a ship cost £3259. 11*s*. 8*d*., what will the whole cost? Also what will $\frac{3}{7}$ cost?

(10) If a certain number of trusses of hay were accurately distributed among 359 horses, each would have $2\frac{82}{359}$ trusses. How many trusses were to be divided?

(11) Simplify $(9\frac{10}{11} + 11\frac{9}{11} + 13\frac{8}{11} + 15\frac{7}{11} + 17\frac{6}{11} + 19\frac{5}{11}) - (8\frac{7}{11} + 7\frac{5}{11} + 6\frac{9}{11} + 6\frac{2}{11} + 5\frac{6}{11} + 4\frac{10}{11})$.

(12) How many times is the difference between $\frac{1}{5}$ of $1\frac{7}{28}$ and $\frac{3}{7}$ of $1\frac{1}{4}$ contained in the sum of 3 times $10\frac{11}{28}$ and 5 times $9\frac{3}{140}$?

(13) Find the length of 7 pieces, if each is $12\frac{5}{9}$ yards long.

(14) Find the length of $5\frac{3}{4}$ pieces, if each is 60 yards long.

(15) Find the length of $147\frac{6}{7}$ pieces, if 9 pieces are $113\frac{2}{5}$ yards long.

EXERCISE XIII.

Reduce to lowest terms:

(1)	$\frac{20}{25}$.	(14)	$\frac{960}{1000}$.	(27)	$\frac{44323}{61087}$.	(40)	$\frac{6}{9}$.
(2)	$\frac{36}{48}$.	(15)	$\frac{35}{100}$.	(28)	$\frac{339}{1243}$.	(41)	$\frac{63}{99}$.
(3)	$\frac{42}{77}$.	(16)	$\frac{875}{10000}$.	(29)	$\frac{1177}{2675}$.	(42)	$\frac{74}{999}$.
(4)	$\frac{18}{27}$.	(17)	$\frac{4375}{10000}$.	(30)	$\frac{11445}{15369}$.	(43)	$\frac{27}{999}$.
(5)	$\frac{28}{112}$.	(18)	$\frac{224}{1000}$.	(31)	$\frac{85359}{94128}$.	(44)	$\frac{630}{9999}$.
(6)	$\frac{56}{84}$.	(19)	$\frac{2640}{2970}$.	(32)	$\frac{85359}{86128}$.	(45)	$\frac{143}{9999}$.
(7)	$\frac{98}{112}$.	(20)	$\frac{324}{1092}$.	(33)	$\frac{6171}{6732}$.	(46)	$\frac{9090}{9999}$.
(8)	$\frac{75}{100}$.	(21)	$\frac{924}{1092}$.	(34)	$\frac{14141}{16289}$.	(47)	$\frac{720}{99999}$.
(9)	$\frac{1300}{1700}$.	(22)	$\frac{6732}{9108}$.	(35)	$\frac{881496}{104768}$.	(48)	$\frac{3280}{99999}$.
(10)	$\frac{625}{1200}$.	(23)	$\frac{3872}{92807}$.	(36)	$\frac{2760}{4485}$.	(49)	$\frac{29810}{99999}$.
(11)	$\frac{66}{121}$.	(24)	$\frac{6840}{27360}$.	(37)	$\frac{5760}{7000}$.	(50)	$\frac{6216}{999999}$.
(12)	$\frac{143}{176}$.	(25)	$\frac{78473}{94653}$.	(38)	$\frac{2205}{2240}$.	(51)	$\frac{65065}{999999}$.
(13)	$\frac{375}{1000}$.	(26)	$\frac{17596}{26145}$.	(39)	$\frac{14028}{28392}$.	(52)	$\frac{8925345}{10581585}$.

(53) If a cake is divided equally among a school of 75 pupils, 30 being boys, what part of the whole cake do the boys get, and what the girls?

(54) The property of a mining company is divided into 6000 shares. A holds 625 shares, B 800 shares, and C 900 shares. What part of the whole mine does each possess, and what part do they hold jointly?

EXERCISE XIV.

Find in two ways:

(1) $\frac{6}{7}$ of £940. 7*s.* 3*d.*

(2) $\frac{10}{11}$ of £1888. 13*s.* 1*d.*

(3) $\frac{5}{12}$ of £2060. 1*s.* 3*d.*

(4) $\frac{5}{6}$ of £21. 19*s.* 3*d.*

(5) $\frac{4}{11}$ of £25. 19*s.* $11\frac{3}{4}$*d.*

(6) $\frac{8}{9}$ of £17. 4*s.* $7\frac{1}{2}$*d.*

EXERCISE XV.

(1) $\frac{1}{74}$ of 111.
(2) $\frac{1}{111}$ of 74.
(3) Divide 60 things among 42 persons.
(4) „ 42 things among 60 persons.
(5) „ 108 things among 144 persons.
(6) „ 144 things into 108 equal parts.
(7) „ 520 things among 195 persons.
(8) „ 195 yards into 520 equal lengths.

EXERCISE XVI.

(1) $17429 \div 387$
(2) $150768 \div 1224$
(3) $150768 \div 132$
(4) $111114 \div 41$
(5) $86354 \div 45$
(6) $1000000 \div 1625$
(7) $195 \div 610$
(8) $26813 \div 73$
(9) $26813 \div 28$
(10) $3465 \div 5355$
(11) $155554 \div 2439$
(12) $73043 \div 42$
(13) $4016093 \div 1517$
(14) $18467 \div 2400$
(15) $77900 \div 1685$
(16) $12219 \div 165$
(17) $438 \div 2100$
(18) $2100 \div 438$

EXERCISE XVII.

(1) £4617. 13*s.* 5*d.* ÷ 2, 3, 4, 5, 6, 7, 8, 9, 10.
(2) £4617. 13*s.* 5*d.* ÷ 17, 151, 367, 5928.
(3) £4617. 13*s.* 5*d.* ÷ 42, 63, 84, 108.
(4) £3815. 6*s.* $2\frac{3}{4}$*d.* ÷ 2, 3, 4, 5, 6, 7, 8, 9, 10.
(5) £3815. 6*s.* $2\frac{3}{4}$*d.* ÷ 17, 151, 367, 5928.
(6) £3815. 6*s.* $2\frac{3}{4}$*d.* ÷ 42, 63, 84, 108.
(7) Find in two ways: $\frac{5}{9}$ of £23. 14*s.* 2*d.*, £23. 14*s.* $2\frac{1}{2}$*d*, £23. 14*s.* $2\frac{3}{4}$*d.*, £23. 14*s.* $2\frac{5}{7}$*d.*
(8) Find $\frac{6}{11}$ of £897. 12*s.* 10*d.*, £897. 12*s.* $10\frac{1}{4}$*d.*, £897. 12*s.* $10\frac{3}{5}$*d.*
(9) Divide $3417\frac{4}{9}$ by 42 in three different ways.
(10) Find the value of £$\frac{6}{13}$, $\frac{7}{8}$ of a guinea, $\frac{3}{5}$ of 1*s.*

Exercise XVIII.

Prove by finding values that:

(1) $\frac{5}{7}$ of £$\frac{3}{8}$ = $\frac{3}{8}$ of £$\frac{5}{7}$.

(2) $\frac{5}{7}$ of $\frac{3}{8}$ of 1 cwt. = $\frac{3}{8}$ of $\frac{5}{7}$ of 1 cwt.

(3) $\frac{5}{7}$ of $\frac{3}{8}$ of 1 yard = $\frac{3}{8}$ of $\frac{5}{7}$ of 1 yard.

(4) $\frac{2}{3}$ of $\frac{7}{11}$ of 1 mile = $\frac{7}{11}$ of $\frac{2}{3}$ of 1 mile.

Exercise XIX.

(1) $\frac{2}{3}$ of $\frac{7}{11}$.

(2) $\frac{2}{3}$ of $\frac{5}{6}$.

(3) $\frac{3}{7}$ of $2\frac{1}{10}$.

(4) $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{3}{4}$ of 4.

(5) $\frac{3}{5}$ of $\frac{10}{27}$ of $\frac{9}{20}$ of $8\frac{1}{3}$.

(6) $\frac{8}{11}$ of $\frac{20}{21}$ of $\frac{35}{48}$ of $2\frac{10}{19}$.

(7) $\frac{8}{9}$ of $\frac{36}{37}$ of $\frac{5}{18}$ of 111.

(8) $\frac{7}{12}$ of $\frac{28}{29}$ of $\frac{26}{35}$ of $7\frac{1}{4}$.

(9) $\frac{2}{3}$ of $\frac{2}{3}$ of $\frac{2}{3}$ of $\frac{2}{3}$.

(10) $\frac{7}{25}$ of $3\frac{4}{7}$.

(11) $\frac{42}{43}$ of $\frac{13}{105}$ of $1\frac{7}{208}$.

(12) $\frac{5}{8}$ of $\frac{120}{121}$ of $\frac{66}{85}$ of 17.

(13) $\frac{14}{15}$ of $\frac{23}{35}$.

(14) $\frac{1}{2}$ of $\frac{1}{3}$ of $\frac{1}{4}$ of $\frac{1}{5}$ of $\frac{1}{6}$.

(15) $\frac{38}{39}$ of $\frac{52}{57}$ of $\frac{69}{86}$ of $1\frac{20}{23}$.

(16) $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{3}{4}$ of $\frac{4}{5}$ of $\frac{5}{6}$ of $\frac{6}{7}$ of $\frac{7}{8}$ of $\frac{8}{9}$ of $\frac{9}{10}$ of 10.

(17) $\frac{1}{10}$ of $\frac{1}{10}$ of $\frac{1}{10}$ of $\frac{1}{10}$ of $\frac{1}{10}$.

(18) $\frac{1}{10}$ of $\frac{2}{9}$ of $\frac{3}{8}$ of $\frac{4}{7}$ of $\frac{5}{6}$ of $1\frac{1}{5}$.

(19) $\frac{5}{11}$ of $\frac{34}{35}$ of $1\frac{4}{51}$.

(20) $\frac{7}{25}$ of $\frac{8}{11}$ of 30.

(21) $\frac{3}{5}$ of $\frac{6}{7}$ of $\frac{3}{11}$ of 4.

(22) $\frac{2}{3}$ of $\frac{4}{9}$ of $\frac{8}{27}$.

(23) $\frac{2}{21}$ of $\frac{7}{9}$ of $\frac{5}{8}$ of $\frac{4}{15}$ of 12.

(24) $\frac{8}{15}$ of $\frac{2}{3}$ of $\frac{12}{13}$ of $\frac{5}{9}$ of 39.

(25) $\frac{8}{15}$ of $\frac{9}{16}$ of $\frac{10}{33}$ of $\frac{11}{21}$ of $\frac{12}{35}$ of $\frac{13}{15}$ of $\frac{14}{39}$ of 20.

(26) $\frac{1}{7}$ of $20 + \frac{3}{7}$ of 61.

(27) $\frac{2}{11}$ of $7 - \frac{1}{22}$ of 6.

(28) $\frac{3}{13}$ of $2 + \frac{3}{13}$ of $3 + \frac{3}{13}$ of $4 + \frac{3}{13}$ of $5 + \frac{3}{13}$ of 6.

(29) $\frac{2}{5}$ of $2\frac{1}{2} + \frac{3}{7}$ of $2\frac{1}{3} + \frac{5}{9}$ of $1\frac{4}{5} + \frac{7}{26}$ of $3\frac{5}{7}$.

(30) $\frac{5}{12}$ of $16 + \frac{11}{12}$ of $20 + \frac{7}{12}$ of $36 + \frac{1}{12}$ of 8.

(31) $\frac{113}{355}$ of $\frac{85}{226}$ of $\frac{12}{35}$ of $1\frac{3}{4}$.

(32) $\frac{7}{8}$ of $\frac{3}{4}$ of $\frac{8}{21}$ of $\frac{4}{5}$ of $\frac{5}{8}$ of $\frac{3}{4}$ of 8.

(33) $\frac{2}{13}$ of $\frac{39}{40}$ of $\frac{52}{117}$.

(34) $\frac{9}{11}$ of $\frac{7}{12}$ of $\frac{22}{63}$ of 48.

(35) $\frac{28}{59}$ of $\frac{3}{8}$ of $\frac{59}{63}$.

(36) $\frac{39}{40}$ of $\frac{7}{65}$ of $\frac{25}{42}$ of 12.

EXERCISE XX.

Shew by finding values that:

(1) $(\frac{1}{2}+\frac{1}{3})$ of £1 $=\frac{5}{6}$ of £1.
(2) „ 13*s.* 9*d.* $=\frac{5}{6}$ of 13*s.* 9*d.*
(3) „ 1 oz. troy $=\frac{5}{6}$ of 1 oz. troy.
(4) „ 1 yard $=\frac{5}{6}$ of 1 yard.
(5) $(\frac{3}{4}+\frac{2}{3})$ of £1 $=1\frac{5}{12}$ of £1.
(6) „ 13*s.* 9*d.* $=1\frac{5}{12}$ of 13*s.* 9*d.*
(7) „ 1 oz. troy $=1\frac{5}{12}$ of 1 oz. troy.
(8) „ 1 yard $=1\frac{5}{12}$ of 1 yard.
(9) „ £2. 11*s.* 6*d.* $=1\frac{5}{12}$ of £2. 11*s.* 6*d.*
(10) $(\frac{3}{4}-\frac{2}{5})$ of £1 $=\frac{7}{20}$ of £1.
(11) $(\frac{4}{5}+\frac{1}{4})$ of 1 oz. troy $=1\frac{1}{20}$ oz. troy.

EXERCISE XXI.

(1) $\frac{4}{5}+\frac{5}{6}$; $\frac{3}{4}+\frac{7}{8}$; $\frac{1}{2}+\frac{1}{6}$; $\frac{1}{2}-\frac{1}{6}$; $\frac{6}{7}-\frac{4}{9}$; $\frac{4}{15}+\frac{11}{20}$; $\frac{5}{16}+\frac{11}{24}$.
(2) $12\frac{5}{8}+7\frac{3}{16}$; $12\frac{5}{8}-7\frac{3}{16}$; $85\frac{7}{12}+27\frac{11}{18}$; $85\frac{7}{12}-27\frac{11}{18}$.
(3) $\frac{1}{2}+\frac{1}{3}+\frac{1}{4}+\frac{1}{5}$; $\frac{1}{2}+\frac{2}{3}+\frac{3}{4}+\frac{4}{5}$; $\frac{5}{6}+\frac{11}{12}+\frac{8}{15}+\frac{7}{20}+\frac{13}{30}$.
(4) $5\frac{17}{20}+11\frac{19}{30}+24\frac{21}{40}+\frac{9}{50}+17\frac{8}{15}+14+11\frac{5}{12}$.
(5) $9\frac{4}{7}+15\frac{11}{28}+103\frac{17}{63}+1\frac{11}{42}+10\frac{1}{4}$.
(6) $1473-279$; $1473\frac{5}{13}-279$; $1473-279\frac{11}{12}$; $1473\frac{5}{13}-279\frac{11}{12}$; $1473\frac{7}{18}-279\frac{11}{12}$.
(7) $\frac{5}{14}+7\frac{8}{25}+11\frac{9}{16}+10\frac{11}{30}+14\frac{5}{8}+100+77\frac{6}{35}$.
(8) $\frac{5}{14}+\frac{6}{11}+9\frac{1}{2}$; $20\frac{5}{12}+11\frac{7}{20}+5\frac{1}{8}+305$; $278\frac{15}{16}-30\frac{5}{12}$.
(9) $\frac{1}{2}+\frac{1}{3}+\frac{1}{4}+\frac{1}{5}+\frac{1}{6}+\frac{1}{7}+\frac{1}{8}+\frac{1}{9}+\frac{1}{10}$; $\frac{1}{2}+\frac{2}{3}+\frac{3}{4}+\frac{4}{5}+\frac{5}{6}+\frac{6}{7}+\frac{7}{8}+\frac{8}{9}+\frac{9}{10}$.
(10) $\frac{1}{2}-\frac{1}{3}$; $\frac{1}{3}-\frac{1}{4}$; $\frac{1}{4}-\frac{1}{5}$; $\frac{1}{5}-\frac{1}{6}$; $\frac{1}{6}-\frac{1}{7}$; $\frac{1}{7}-\frac{1}{8}$; $\frac{1}{8}-\frac{1}{9}$; $\frac{1}{9}-\frac{1}{10}$.
(11) $\frac{5}{17}+\frac{11}{34}+\frac{14}{51}+\frac{19}{68}$; $\frac{11}{38}+\frac{14}{57}+\frac{17}{76}$; $\frac{9}{13}+\frac{5}{39}+\frac{17}{52}$.
(12) $118\frac{5}{11}-17\frac{3}{14}$; $94\frac{5}{11}-91\frac{13}{14}$; $125\frac{5}{22}-10\frac{17}{33}$; $40\frac{1}{2}-30\frac{47}{90}$.
(13) $\frac{1}{2}-\frac{1}{3}+\frac{1}{4}-\frac{1}{5}+\frac{1}{6}$; $\frac{4}{7}+\frac{2}{9}-\frac{3}{5}+\frac{11}{21}$.
(14) $\frac{1}{2}$ of $\frac{1}{3}+\frac{1}{3}$ of $\frac{1}{4}$; $\frac{2}{5}$ of $\frac{10}{11}+\frac{3}{8}$ of $\frac{16}{33}$; $\frac{1}{12}$ of $11+\frac{1}{11}$ of 12.
(15) $\frac{2}{11}$ of $210+\frac{7}{12}$ of $210+\frac{5}{8}$ of $7\frac{1}{11}$.
(16) $3\frac{5}{24}+7\frac{11}{12}+8\frac{13}{16}+9\frac{14}{15}$.

(17) $\frac{1}{7}$ of $5\frac{4}{9} + \frac{2}{13}$ of $1\frac{2}{37} + \frac{2}{3}$ of $\frac{17}{37}$.

(18) $\frac{7}{20}$ of $63 - \frac{3}{50}$ of $7\frac{1}{2}$.

(19) $\frac{15}{16}$ of $7\frac{3}{5} + \frac{3}{17}$ of $10\frac{1}{5} - \frac{5}{7}$ of $2\frac{9}{10}$.

(20) *a.* $\frac{3}{10} + \frac{7}{100} + \frac{9}{1000} + \frac{5}{10000}$; $\frac{8}{100} + \frac{17}{10000} + \frac{9}{100000}$.

b. $\frac{1}{10} + \frac{1}{100} + \frac{1}{1000} + \frac{1}{10000} + \frac{1}{100000}$.

c. $\frac{1}{10} + \frac{2}{100} + \frac{3}{1000} + \frac{4}{10000} + \frac{5}{100000}$.

d. $\frac{1}{10} + \frac{1}{1000} + \frac{1}{100000} + \frac{1}{10000000}$.

e. $\frac{7}{10} + \frac{9}{100} + \frac{4}{10000}$.

f. $\frac{3}{100} + \frac{4}{1000} + \frac{7}{1000000}$.

g. $\frac{17}{10} + \frac{17}{100} + \frac{17}{1000} + \frac{17}{10000} + \frac{17}{100000}$.

h. $\frac{143}{100} + \frac{2471}{1000} + \frac{82643}{1000000}$.

(21) Which is the greater of each of the following pairs, and by how much: $\frac{5}{8}$ or $\frac{7}{11}$; $\frac{4}{17}$ or $\frac{15}{67}$; $\frac{4}{17}$ or $\frac{15}{68}$; $\frac{2}{11}$ or $\frac{9}{50}$?

(22) Also of $\frac{1}{2}$ of $\frac{1}{3}$ and $\frac{1}{4}$ of $\frac{3}{5}$; $\frac{2}{11}$ of $3\frac{1}{2}$ and $\frac{4}{11}$ of $1\frac{3}{4}$?

(23) Add together the sum and the difference of $\frac{9}{20}$ of $7\frac{3}{8}$, and $\frac{5}{14}$ of $3\frac{3}{40}$.

(24) Find the difference between $\frac{1}{8}$ and $\frac{3}{10}$; $\frac{4}{11}$ and $\frac{36}{100}$; $\frac{6}{7}$ and $\frac{857142}{1000000}$; $\frac{1}{960}$ and $\frac{1}{1000}$.

(25) $43\frac{7}{15} - 1\frac{1}{3} - 1\frac{31}{48} - 1\frac{23}{24} - 2\frac{13}{48} - 2\frac{7}{12} - 2\frac{43}{48} - 3\frac{5}{12}$.

(26) $43\frac{7}{15} - (1\frac{1}{3} + 1\frac{31}{48} + 1\frac{23}{24} + 2\frac{13}{48} + 2\frac{7}{12} + 2\frac{43}{48} + 3\frac{5}{12})$.

(27) $(\frac{1}{2} + \frac{4}{13} + 7\frac{9}{40} + 8\frac{14}{39} + 7\frac{1}{4} + 8\frac{3}{10} + 4\frac{1}{12}) - 36\frac{1}{40}$.

(28) $(8\frac{5}{18} + 9\frac{10}{27} + 17\frac{11}{36} + 40) - (30\frac{13}{40} + 11\frac{11}{20})$.

(29) $(172\frac{19}{78} + 93\frac{14}{117}) + (172\frac{19}{78} - 93\frac{14}{117})$.

(30) $(172\frac{19}{78} + 93\frac{14}{117}) - (172\frac{19}{78} - 93\frac{14}{117})$.

(31) $6\frac{3}{4} + \frac{27}{5} + \frac{5}{12} \times 3 + \frac{7}{18} \times 5 + 6\frac{2}{5} \div 4 + 1\frac{1}{8} \div 2 + \frac{5}{9}$ of $\frac{3}{4}$.

(32) A bequeathed to his two sons $\frac{1}{4}$ of his property each, to each of his three daughters $\frac{1}{9}$ of his property, to his nephew $\frac{1}{18}$ of his property, and a like sum to his niece; the remainder, £1000, to a hospital. Find the value of the whole property, and the shares in money of the several heirs.

(33) A was condemned to pay $\frac{11}{96}$ of the costs of a law-suit; B had to pay $\frac{11}{39}$ of the same costs; C had to pay the remainder, amounting to £12. 11*s*. Find the costs of the whole suit.

(34) In a cricket-match, 11 players made a certain number of runs; the first made $\frac{1}{10}$ of the total number, the next three each $\frac{5}{30}$, the next five each $\frac{1}{15}$, and the two last 18 runs between them. The other side made successively $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, $\frac{1}{6}$, $\frac{1}{10}$, $\frac{1}{12}$, $\frac{1}{15}$, $\frac{1}{20}$, $\frac{1}{30}$, $\frac{1}{40}$ and $\frac{1}{60}$ of their opponents' total. Which side had won, and by how much?

EXERCISE XXII.

(1) $\frac{1}{2} \times \frac{1}{3}$; $\frac{1}{7} \times \frac{1}{8}$; $\frac{1}{20} \times \frac{3}{5}$; $\frac{15}{16} \times \frac{18}{25}$; $\frac{4}{21} \times \frac{28}{29}$.

(2) $4\frac{1}{2} \times 6$; $4\frac{1}{2} \times 6\frac{1}{2}$; $4\frac{1}{3} \times 6\frac{1}{4}$; $100\frac{3}{8} \times 4\frac{4}{11}$.

(3) $7\frac{1}{4} \times \frac{18}{25} \times \frac{13}{58} \times \frac{8}{39} \times 5$; $4\frac{1}{2} \times 5\frac{1}{4} \times 5\frac{1}{3} \times 13$.

(4) $\frac{1}{10} \times \frac{1}{10}$; $\frac{3}{10} \times \frac{7}{10}$; $\frac{11}{100} \times \frac{7}{10000}$; $\frac{13}{100} \times \frac{13}{10000} \times \frac{13}{1000000}$.

(5) $5\frac{7}{10} \times 81\frac{13}{100} \times 4\frac{7}{1000}$; $7\frac{1}{10} \times 8\frac{1}{10} \times 9\frac{1}{10}$.

(6) $2\frac{1}{4} \times 20\frac{1}{4} \times \frac{26}{27}$; $\frac{5}{38} \times \frac{57}{65} \times 3\frac{1}{4}$; $\frac{2}{3} \times \frac{2}{3} \times \frac{2}{3}$; $4\frac{1}{5} \times 4\frac{1}{5} \times 4\frac{1}{5} \times 4\frac{1}{5}$.

EXERCISE XXIII.

(1) $8 \div \frac{2}{3}$.
(2) $\frac{2}{3} \div 8$.
(3) $\frac{4}{5} \div \frac{3}{7}$.
(4) $\frac{3}{7} \div \frac{4}{5}$.
(5) $1\frac{4}{5} \div \frac{1}{5}$.
(6) $1\frac{4}{5} \div 5$.
(7) $1\frac{4}{5} \div 3$.
(8) $1\frac{4}{5} \div \frac{3}{5}$.
(9) $1\frac{4}{5} \div 1\frac{1}{8}$.
(10) $\frac{1}{5} \div 1\frac{4}{5}$.
(11) $\frac{3}{5} \div 1\frac{4}{5}$.
(12) $3 \div 1\frac{4}{5}$.
(13) $8\frac{4}{7} \div 4\frac{4}{9}$.
(14) $11 \div 76$.
(15) $11 \div 55$.
(16) $55 \div 11$.
(17) $1\frac{5}{7} \div \frac{2}{3}$.
(18) $1\frac{5}{7} \div 1\frac{2}{3}$.
(19) $5\frac{5}{8} \div 15$.
(20) $5\frac{5}{8} \div 3\frac{3}{4}$.
(21) $10 \div 2\frac{1}{2}$.
(22) $25 \div 3\frac{1}{8}$.
(23) $\frac{15}{16} \div 7\frac{1}{2}$.
(24) $\frac{11}{12} \div 1\frac{3}{8}$.
(25) $\frac{19}{20} \div 7\frac{3}{5}$.
(26) $\frac{25}{26} \div 1\frac{1}{4}$.
(27) $\frac{13}{15} \div 6\frac{1}{2}$.
(28) $19\frac{1}{3} \div \frac{29}{48}$.
(29) $5\frac{5}{6} \div \frac{21}{22}$.
(30) $18\frac{3}{4} \div 1\frac{7}{8}$.
(31) $9\frac{3}{8} \div 4\frac{2}{7}$.
(32) $100\frac{5}{9} \div 8\frac{4}{9}$.
(33) $23\frac{1}{3} \div 11\frac{2}{5}$.
(34) $588\frac{1}{8} \div 91\frac{1}{8}$.
(35) $1819\frac{3}{10} \div 81\frac{5}{7}$.
(36) $21 \div (\frac{15}{19}$ of $3\frac{4}{5})$.
(37) $18\frac{117}{256} \div (\frac{5}{8}$ of $33\frac{3}{4})$.
(38) $3\frac{1}{3} \div (\frac{2}{3} \times 1\frac{1}{3})$.
(39) $(3\frac{1}{11} \times 5\frac{1}{17}) \div 1720$.
(40) $(3\frac{1}{2} \times \frac{8}{9}$ of $\frac{4}{7}) \div 1\frac{3}{5}$.
(41) $(\frac{28}{59} \times \frac{59}{63}) \div (\frac{1}{6} \times 4 \times \frac{2}{3})$.
(42) $(13\frac{5}{6} \times \frac{2}{5} \times \frac{9}{65}) \div (\frac{2}{3}$ of $1\frac{44}{65} \times 1\frac{1}{3})$.

(43) £8. 7*s.* 10*d.* $\div 1\frac{2}{5}$.

(44) 13*s.* $8\frac{1}{4}$*d.* $\div 4\frac{7}{8}$.

(45) 4 days, 5 hours $\div 1\frac{5}{7}$.

(46) 3 qrs., 5 lbs., 8 oz. $\div 6\frac{2}{5}$.

(47) Find the cost of 1 article if $\frac{7}{10}$ cost 6*s.* 5*d.*

(48) If I earn 8*s.* 5*d.* in $1\frac{3}{8}$ days, how much is that a day?

(49) If a soldier step $\frac{3}{4}$ of a yard, how many steps will he take in $1\frac{7}{8}$ miles?

(50) Divide $(\frac{17}{20} + \frac{11}{15} + \frac{7}{10} + \frac{4}{5})$ by $(\frac{17}{20} - \frac{11}{15} + \frac{7}{10} - \frac{4}{5})$.

(51) Divide $(4\frac{1}{7} - 2\frac{1}{4})$ by $(6\frac{1}{2} - 2\frac{1}{7})$.

EXERCISE XXIV.

(Miscellaneous Questions on the Four Rules.)

(1) Find the sum of $4\frac{7}{12}$, $5\frac{2}{9}$, $7\frac{13}{16}$, and $10\frac{11}{20}$.

(2) What quantity exceeds $5\frac{2}{9}$ by $4\frac{7}{8}$?

(3) From what quantity must $6\frac{3}{5}$ be deducted to leave $\frac{1}{2}$ of $3\frac{1}{9}$?

(4) There are two fractions, the less is $10\frac{14}{25}$, their difference is $6\frac{8}{15}$. Find the greater.

(5) If from a certain quantity $2\frac{6}{7}$ be taken, $4\frac{11}{14}$ is left. Find the quantity.

(6) Of two weavers, A and B, A wove $9\frac{7}{10}$ pieces more than B, who wove $6\frac{11}{40}$ pieces. Find the total quantity woven.

(7) $5\frac{8}{11}$ exceeds a certain fraction by $(4 \div 2\frac{1}{3})$. Find the fraction.

(8) What fraction falls short of $\frac{7}{12}$ by $\frac{3}{20}$?

(9) What fraction is that to which $\frac{5}{76}$ must be added to give $\frac{11}{57}$?

(10) There are two fractions, the greater is $12\frac{7}{18}$, and their difference is $7\frac{53}{54}$. Find the less.

(11) What fraction increased by $\frac{1}{100}$ becomes $\frac{1}{10}$?

(12) Find a fraction which, repeated 3 times and increased by $14\frac{2}{9}$, makes 100.

(13) Find a fraction which, repeated 3 times and diminished by $14\frac{2}{9}$, makes 100.

(14) In a pair of scales, one contains $7\frac{4}{15}$ lbs., the other contains $11\frac{7}{9}$ lbs. Find the number of lbs. which drags down the heavier scale.

(15) Find the product of $4\frac{4}{9}$ and $3\frac{3}{8}$.

(16) What fraction must be divided by $7\frac{1}{2}$ to yield $7\frac{1}{2}$?

(17) From what number or fraction can $4\frac{17}{36}$ be taken 9 times exactly?

(18) From what fraction can $3\frac{5}{8}$ be taken $2\frac{1}{2}$ times, leaving remainder $3\frac{1}{2}$?

(19) Of what fraction is $10\frac{14}{15}$ the 10th part?

(20) What fraction divided by $4\frac{5}{7}$ gives the quotient $\frac{2}{3}$?

(21) What is the 7th part of $1\frac{1}{2}$?

(22) What fraction is that of which we must take $6\frac{2}{3}$ to get $5\frac{1}{2}$?

(23) By what fraction must 10 be multiplied to give 7?

(24) The product of two fractions is $\frac{5}{8}$; one factor is $1\frac{1}{4}$. Find the other.

(25) Given divisor $3\frac{1}{5}$, quotient $3\frac{1}{5}$. Find dividend.

(26) Given dividend $\frac{11}{12}$, quotient $6\frac{1}{2}$. Find divisor.

(27) Given dividend $\frac{11}{12}$, divisor $6\frac{1}{2}$. Find quotient.

(28) Given dividend $12\frac{17}{72}$, quotient 3, remainder $1\frac{5}{12}$. Find divisor.

EXERCISE XXV. (*a*).

(1)	Find the cost of	30	articles, if	18	cost	£5. 7*s*. 6*d*.
(2)	"	45	"	20	"	£7. 17*s*. 6*d*.
(3)	"	60	"	25	"	£0. 17*s*. 10*d*.
(4)	"	150	"	210	"	£15. 15*s*.
(5)	"	210	"	150	"	£15. 15*s*.
(6)	"	68	"	153	"	£37. 8*s*. 9*d*.

(7) If it takes $7\frac{1}{2}$ hours to travel 150 miles, how long will it take to travel 220 miles?

(8) If 1800 men require 475 cwt. of food, how much will 2250 men require?

(9) If I pay £3. 15*s*. for the loan of £100, what shall I pay for the loan of £385?

(10) What shall I pay for the loan of £566 at 5 per cent. (i.e. at £5 for every £100)?

(11) Find the interest on £439 at $7\frac{1}{2}$ per cent.

(12) Find the interest on £1050 at $7\frac{3}{8}$ per cent.

EXERCISE XXV. (*b*).

(1) If for £17. 18*s*. 4*d*. I can buy 60 articles, how many can I buy for £10. 15*s*.?

(2) If 30 men earn £53. 3*s*. 1½*d*. in a week, how many men will it take to earn £177. 3*s*. 9*d*.?

(3) If 10 oz. of gold cost £38. 18*s*. 9*d*., how many ounces can be bought for £408. 16*s*. 10½*d*.?

(4) If iron plates cost £20 per ton, what weight can I buy for 17*s*. 6*d*.?

(5) If £3. 15*s*. pays for the loan of £80, how much can I borrow for £5?

(6) How much money at 5 per cent. can I borrow with £72. 15*s*. a-year?

(7) How much at £3. 15*s*. per cent. can I borrow with £100?

(8) If an agent is paid £2. 10*s*. for every £100 worth of goods sold, how much must he sell to earn £27. 15*s*.?

(9)	Find the interest on	£777. 15*s*.	at 7½	per cent.
(10)	"	£843. 10*s*.	at 4	"
(11)	"	£1050.	at 3¾	"
(12)	"	£19.	at 10	"

EXERCISE XXV. (*c*).

(1) If 15 tons cost £17. 10*s*., what will 8 tons, 15 cwt. cost?

(2) If 6 cwt., 1 qr., 15 lbs. cost £13. 14*s*. 7½*d*., what will 18 cwt., 19 lbs. cost?

(3) If 5 oz., 10 dwts. of gold cost £21. 8*s*. 3¾*d*., what is the value of 3 oz., 5 dwts.?

(4) If 1 lb. troy of silver is worth £3. 3*s*., what is the value of 6 silver spoons, each weighing 4 oz., 11 dwts.?

(5) If on a velocipede I can travel 20½ miles in 54 minutes, how long would it take me to travel 35 miles?

(6) If the sun passes over 360° of longitude in 24 hours, how long will it take from the meridian of London to that of New York, which are 75° apart?

(7) If for the loan of £325. 10*s.* I pay £16. 5*s.* 6*d.*, what should I pay for the loan of £59. 15*s.*?

(8) If a partner holding £747. 12*s.* 6*d.* in a concern draws a profit of £56. 1*s.* $5\frac{1}{4}$*d.*, what ought a partner holding £812. 15*s.* to draw?

(9) If for the loan of a sum of money for 7 months I pay £7. 17*s.* 6*d.*, what ought I to pay for a year?

(10) If I pay £1. 17*s.* 10*d.* commission on an amount of £75. 13*s.* 4*d.*, how much is that per cent. (i.e. on £100)?

(11) If a house rated at £45 pays a tax of £3. 11*s.* 8*d.*, what must a house be rated at that pays a tax of £5. 14*s.* 8*d.*?

(12) If Government Stock costing £92. 12*s.* 6*d.* yields a profit of £3. 10*s.*, what profit should I get from Stock costing £271. 14*s.*?

(13) 3000 Prussian feet exceed 3000 French feet by 100 Prussian feet; how many French feet are there in 1000 Prussian feet?

(14) If 8 kilometres are 4 miles, 7 fur., 168 yds., how many miles are there in 11 kilometres, and how many kilometres are there in 11 miles?

(15) If 7 doz. and 9 bottles of wine cost £22. 1*s.* 9*d.*, how much wine shall I get for £11. 17*s.* 6*d.*?

EXERCISE XXV. (*d*).

(1) If $\frac{4}{9}$ of an article cost 3*s.* 9*d.*, what would $2\frac{3}{5}$ articles cost?

(2) If $2\frac{4}{7}$ guineas gain 4*s.* 6*d.*, what will be the profit on $3\frac{5}{6}$ guineas?

(3) If on a velocipede I travel $3\frac{3}{5}$ miles in $7\frac{1}{2}$ minutes, how many miles shall I travel in 50 minutes, and how long shall I take to travel 50 miles?

(4) If $25\frac{11}{50}$ francs are worth £1, how many francs shall I get for 16*s.*, and how much sterling money for a Napoleon (20 francs)?

(5) If a French ton is $\frac{49}{50}$ of an English ton, how many English tons, &c., are there in 700 French tons, and how many French tons in 700 English tons?

(6) If a stick $7\frac{1}{2}$ feet long throw a shadow of $8\frac{3}{4}$ feet, how high will the steeple be whose shadow is 50 yds., 6 in. long?

(7) A certain wheel makes 1760 turns in travelling a distance of 2 miles; how many turns would it make in travelling 1000 yards?

Exercise XXV. (*e*).

(1) If from a sack of flour I can make 45 loaves weighing 3 lbs. each, how many 4 lb. loaves can I make from it?

(2) If I have enough money to buy 50 articles at 3*s.* 6*d.* each, how many articles at 2*s.* 1*d.* each can I buy?

(3) If 30 bushels keep 50 horses for a week, how many horses would they keep for 25 days?

(4) If 30 bushels keep 50 horses for a week, for how long would they keep 15 horses?

(5) If 30 bushels keep 50 horses for a week, how many bushels would be required to keep 69 horses for the same time?

(6) How many yards at 5*s.* 6*d.* each must be given for 30 yards at 3*s.* 9*d.* each?

(7) The savings of a professional man are sufficient to purchase an annuity of £375, paying £80 cash for every £6. 10*s.* a year; how large an annuity will his money purchase if he waits till he has only to pay £65 cash for £6. 10*s.* a year?

Exercise XXV. (*f*).

(1) If 50 yards of calico 21 inches wide cost 11*s.* $5\frac{1}{2}$*d.*, what would $87\frac{1}{2}$ yards 27 inches wide cost?

(2) If 2 tons, 5 cwt. can be carried over 150 miles for 14*s.* 6*d.*, what weight can be carried a distance of 200 miles for £1. 4*s.* 2*d.*?

(3) If 12 spoons, each weighing 14 dwts., 14 grs., are worth £3. 5*s.* $7\frac{1}{2}$*d.*, what is the value of 21 spoons each weighing 1 oz.?

(4) If £275 gain £37. 10*s.* in 9 months, what should £990 gain in $2\frac{1}{2}$ months?

(5) Find the interest on £450 for 2 years at 4 per cent.

[Statement: Interest on £100 for 1 year is £4.]

(6) Find the interest on £760 for $1\frac{1}{2}$ years at $4\frac{1}{2}$ per cent.

(7) Find the interest on £45 for 8 months at $3\frac{3}{4}$ per cent.

(8) What sum of money will in $2\frac{1}{2}$ years at 5 per cent. yield £87. 10*s.* interest?

(9) At what rate per cent. will £75 yield £1. 15*s.* interest in 7 months?

(10) At what rate per cent. will £120 yield £3. 12*s.* interest in 146 days?

EXERCISE XXV. (*g*).

(1) If 750 men require 22,500 rations of food, how many rations will 1200 men require?

(2) If the clothing of 750 men costs £2831. 5*s.*, what will the clothing of 3500 men cost?

(3) If 7 cwt., 1 qr. cost £26. 10*s.* 4*d.*, what will 43 cwt., 2 qrs. cost?

(4) A garrison of 536 men has provisions to last from March 1st to Dec. 6th; how long will the provisions last if the garrison is increased by 588 men?

(5) What is the cost of 172 pieces of lead, each weighing 3 cwt., 2 qrs., $17\frac{1}{2}$ lbs., at £8. 17*s.* 6*d.* for $19\frac{1}{2}$ cwt.?

(6) If a wheel makes $2\frac{3}{4}$ turns in 1 minute and 17 seconds, how often will it revolve in 7 hours?

(7) If travelling at the rate of $12\frac{1}{2}$ miles an hour I require $15\frac{1}{2}$ hours to complete the journey, in how many hours shall I complete it if I increase the rate of travelling by $7\frac{1}{2}$ miles an hour?

(8) If £59. 10*s.* is required to buy an annuity of £8. 10*s.* a year, how much would be required to buy an annuity of £50?

(9) If with my money I can buy an annuity of £50 at the rate of £85 cash for every yearly £3. 10*s.*, what annuity will my money purchase if I pay £75 cash for every £3. 5*s.* a year?

(10) Find the interest on £548. 10*s.* 6*d.* at $4\frac{1}{2}$ per cent.

(11) What sum of money will at $5\frac{1}{2}$ per cent. produce the same interest that 1000 guineas produce at $3\frac{3}{4}$ per cent.?

(12) If in 1375 ounces of air there be $13\frac{3}{4}$ ounces of vapour, how much vapour would be contained in 1000 ounces of air?

(13) In what time will £524 at 5 per cent. yield £4. 7*s.* 4*d.* interest?

(14) If a house rated at £85 pays £4. 7*s.* 10*d.* rates, what will be paid upon a house rated at £245?

(15) In "quick" marching, soldiers take 110 steps of 30 inches per minute; at the "double" they take 150 steps of 36 inches per minute; if 1000 soldiers marching quick in fours take 2 minutes to pass a house, how long will 720,000 men eighteen abreast take at the double?

EXERCISE XXVI. (*a*).

(1) What fraction of 8 is 3?
(2) " 3 is 8?
(3) " 9 is 5?
(4) " 5 is 9?
(5) " 12 is 9?
(6) " 9 is 12?
(7) " $1\frac{1}{5}$ is $\frac{2}{5}$?
(8) " $\frac{2}{5}$ is $1\frac{1}{5}$?
(9) " $1\frac{7}{8}$ is $\frac{5}{16}$?
(10) What fraction of $\frac{5}{16}$ is $1\frac{7}{8}$?
(11) " $3\frac{1}{5}$ is $\frac{8}{15}$?
(12) " £1 is 1*s.*?
(13) " £1 is 6*d.*?
(14) " £1 is 3*d.*?
(15) " £1 is 1*d.*?
(16) " £1 is $\frac{1}{2}$*d.*?
(17) " £1 is $\frac{1}{4}$*d.*?
(18) " £1 is 16*s.*?
(19) What fraction of £1 is 11*s.*?
(20) " £1 is 2*s.* 10*d.*?
(21) " £1 is 1*s.* $2\frac{3}{4}$*d.*?
(22) " £1 is 4*s.* $11\frac{1}{4}$*d.*?
(23) " £1 is 13*s.* 4*d.*?
(24) " £1 is 17*s.* $10\frac{3}{4}$*d.*?

EXERCISE XXVI. (*b*).

(1) What fraction of £58 is £29?
(2) " £29 is £58?
(3) " £3. 17*s.* $4\frac{1}{2}$*d.* is £1. 11*s.* $1\frac{1}{2}$*d.*?

(4) What fraction of £1. 11*s.* $1\frac{1}{2}$*d.* is £3. 17*s.* $4\frac{1}{2}$*d.*?
(5) „ £8. 10*s.* 10*d.* is 15*s.* 4*d.*?
(6) „ 15*s.* 4*d.* is £8. 10*s.* 10*d.*?
(7) „ £3. 2*s.* $7\frac{1}{4}$*d.* is £1?
(8) „ £1 is £3. 2*s.* $7\frac{1}{4}$*d.*?
(9) „ 2 tons, 13 cwt., is 1 ton, 1 cwt., 1 qr.?
(10) „ 2 lbs., 10 oz. av., is 1 lb. $4\frac{1}{2}$ oz. av.?
(11) „ 5 lbs., 9 oz. troy, is 6 oz., 15 dwts.?
(12) „ 2 yrs., 73 days, is 146 days?
(13) „ 5 tons, 8 cwt., 21 lbs., is 3 cwt., 17 lbs., 12 oz.?
(14) Reduce £2. 10*s.* 6*d.* to the fraction of £1. 10*s.* 9*d.*
(15) „ 6*s.* 7*d.* „ £8.
(16) „ 2 lbs., 10 oz. av. „ 2 lbs., 10 oz. troy.
(17) „ 5 minutes „ 1 day.
(18) „ $1\frac{1}{2}$*d.* „ 1 guinea.
(19) „ $1\frac{1}{2}$ pints „ $2\frac{1}{2}$ gallons.
(20) „ 1 lb. av. „ 1 lb troy.

Exercise XXVII.

(1) $\dfrac{1}{3\frac{1}{8}}$

(2) $\dfrac{1}{3\frac{3}{8}}$

(3) $\dfrac{5}{3\frac{3}{8}}$

(4) $\dfrac{5\frac{1}{2}}{3\frac{3}{8}}$

(5) $\dfrac{3\frac{3}{8}}{5\frac{1}{2}}$

(6) $\dfrac{\frac{11}{12}}{3\frac{7}{16}}$

(7) $\dfrac{4\frac{8}{27}}{2\frac{14}{81}}$

(8) $\dfrac{5\frac{13}{24}}{2\frac{19}{48}}$

(9) $\dfrac{2\frac{5}{8}}{8\frac{3}{5}} \times \dfrac{8\frac{3}{5}}{2\frac{5}{8}}$

(10) $\dfrac{2\frac{5}{8} \times 8\frac{3}{5}}{8\frac{3}{5} \div 2\frac{5}{8}}$

(11) $\dfrac{2\frac{5}{8} + 8\frac{3}{5}}{8\frac{3}{5} - 2\frac{5}{8}}$

(12) $\dfrac{\frac{1}{2} + \frac{1}{3} + \frac{1}{4}}{\frac{1}{2\frac{1}{2}} + \frac{1}{3\frac{1}{2}} + \frac{1}{4\frac{1}{2}}}$

(13) $\dfrac{\frac{7}{8} + \frac{4}{5} + \frac{1}{10}}{\frac{1}{8} + \frac{1}{45} + \frac{1}{72}}$

(14) $\dfrac{\frac{7}{8} - (\frac{4}{5} + \frac{1}{10})}{\frac{1}{8} + \frac{1}{45} - \frac{1}{72}}$

(15) $\dfrac{1\frac{4}{17} \times 6\frac{4}{5}}{3\frac{3}{8} - 1\frac{2}{25}} + \dfrac{2}{11}$ of $(2\frac{2}{5} - \frac{3}{4}) - \dfrac{1\frac{3}{5}}{12}$

(16) $3\frac{1}{3} \div \dfrac{1 - \frac{15}{16}}{\frac{1}{3} - \frac{1}{9}}$

(17) $\cfrac{1}{2+\cfrac{1}{3\frac{1}{3}-\frac{2}{3}}}$

(18) $\cfrac{1}{2+\cfrac{1}{3+\cfrac{1}{4}}}$

(19) $\cfrac{1}{1+\cfrac{1}{1+\cfrac{1}{1}}}$

(20) $\cfrac{1}{1+\cfrac{1}{1+\cfrac{1}{1+\cfrac{1}{1+\cfrac{1}{1}}}}}$

(21) $\cfrac{1}{2+\cfrac{1}{1+\cfrac{1}{15+\cfrac{1}{8+\cfrac{1}{1+\cfrac{1}{2}}}}}}$

(22) $3+\cfrac{1}{7+\cfrac{1}{15+\cfrac{1}{1+\cfrac{1}{25+\cfrac{1}{1+\cfrac{1}{7+\cfrac{1}{4}}}}}}}$

(23) $\dfrac{\frac{1}{2}+\frac{4}{9}+\frac{11}{27}}{\frac{1}{4}+\frac{5}{6}+\frac{11}{12}}$ of $\dfrac{\frac{5}{8}\text{ of }2\frac{1}{3}\div1\frac{11}{24}}{\frac{16}{27}\text{ of }4\frac{5}{8}\div9\frac{1}{4}}$

EXERCISE XXVIII.

(1) Find G. C. M. and L. C. M. of $5\frac{1}{2}$, $7\frac{1}{3}$, $8\frac{1}{4}$, $4\frac{8}{9}$, $9\frac{1}{6}$, $6\frac{5}{12}$.
(2) " " $33\frac{3}{7}$ and $50\frac{5}{8}$.
(3) " " $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, $\frac{1}{6}$, $\frac{1}{10}$ $\frac{1}{12}$.
(4) " " $50\frac{1}{2}$, $67\frac{1}{3}$, $44\frac{8}{9}$, $84\frac{1}{6}$, 707.
(5) " " $225\frac{3}{5}$ and $181\frac{2}{7}$.
(6) " " $\frac{4}{5}$, $\frac{5}{6}$, $\frac{6}{7}$, $\frac{7}{8}$, $\frac{8}{9}$, $\frac{9}{10}$.
(7) " " $1\frac{1}{14}$, $1\frac{19}{21}$, $4\frac{2}{7}$, $\frac{25}{42}$.

EXERCISE XXIX.

	From length,			breadth,			find area:
(1)	15	linear	feet,	7	linear	feet.	
(2)	10	"	yds.,	3	"	yds.	
(3)	5	"	in.,	2	"	in.	
(4)	1	"	foot,	1	"	in.	
(5)	2	"	yds.,	4	"	feet.	
(6)	12	"	in.,	12	"	in.	
(7)	3	"	feet,	3	"	feet.	
(8)	1760	"	yds.,	1760	"	yds.	

EXERCISE XXX.

From (or) Given } Area, and one side, find other side:

(1)	36	square yds.,	9	linear yds.	
(2)	28	„ in.,	7	„	in.
(3)	100	„ feet,	5	„	feet.
(4)	100	„ miles,	10	„	miles.

EXERCISE XXXI.

(1) Find the area, given:

a.	Length,	1 yd., 2 ft., 9 in.	breadth,	2 ft., 8 in.
b.	„	2 yds., 1 ft., $7\frac{1}{2}$ in.	„	$10\frac{1}{2}$ in.
c.	„	17 yds., 2 ft., 3 in.	„	1 yd., 1 ft., 10 in.
d.	„	10 yds., 2 ft., 11 in.	„	1 yd.
e.	„	1 ft., $1\frac{1}{2}$ in.	„	1 ft.
f.	„	36 yds.	„	4 yds., 1 ft., 5 in.
g.	„	$\frac{7}{11}$ yd.	„	$\frac{3}{8}$ yd.
h.	„	$\frac{7}{11}$ yd.	„	$\frac{3}{8}$ ft.
k.	„	$2\frac{5}{9}$ ft.	„	$5\frac{3}{8}$ in.
l.	„	$\frac{1}{2}$ in.	„	$\frac{1}{2}$ in.

(2) A room is 20 ft. long, 14 ft., 6 in. broad, and 11 ft., 9 in. high. How many square feet of carpet will be required, and how many of paper?

(3) What length of carpet, 2 ft., 3 in. wide, and of paper, 1 ft., 9 in. wide, will be required?

(4) How many acres in a square furlong?

(5) A rod or pole is $5\frac{1}{2}$ yds. How many square yards in a square rod?

(6) Express in acres the difference between half a square mile and half a mile square.

(7) Find the difference between 2 square furlongs and 2 furlongs square.

(8) The difference between $3\frac{1}{8}$ square yards and $3\frac{1}{8}$ yards square.

(9) Find the one side, given:

a.	Area, 50 square ft.	the other side,	$3\frac{1}{2}$ yds.
b.	„ $185\frac{2}{3}$ square ft.	„	4 yds. 2 ft., $7\frac{1}{2}$ in.
c.	„ $6\frac{1}{2}$ square ft.	„	$10\frac{2}{5}$ ft.

(10) How many pieces of paper, 12 yds. long and 21 in. wide, will paper a room $5\frac{1}{4}$ yds. wide, $7\frac{1}{2}$ yds. long, $8\frac{3}{4}$ ft. high, and what will be the cost at 2*s.* $10\frac{1}{2}$*d.* per piece?

(11) Find the difference in expense between carpeting a room 18 ft. long, 13 ft., 8 in. wide, with Brussels, 27 in. wide, at 5*s.* 6*d.* a yard, and with Kidderminster a yard wide at 3*s.* 9*d.* a yard.

(12) Find the cost of 9 venetian blinds, 7 ft., 10 in. long, and 4 ft. $7\frac{1}{2}$ in. wide, at $8\frac{1}{2}$*d.* per square foot.

Exercise XXXII.

	From length,	breadth,	thickness, find volume:
(1)	8 ft.	5 ft.	3 ft.
(2)	10 in.	10 in.	10 in.
(3)	1 yd.	1 ft.	1 in.
(4)	$2\frac{1}{2}$ yds.	$1\frac{3}{4}$ yds.	$\frac{5}{8}$ yds.
(5)	10 yds., 1 ft.	2 ft., 8 in.	1 ft., $10\frac{1}{2}$ in.
(6)	1 mile	15 yds.	$10\frac{1}{2}$ ft.

Exercise XXXIII.

(1) Given volume, length, and breadth, find thickness:

a.	120 cub. ft.	8 ft.	5 ft.
b.	5760 cub. in.	1 yd.	1 ft., 8 in.
c.	9 cub. yds., 7 ft., 1512 in.	6 yds., 7 in.	2 ft., 3 in.
d.	1 cub. yd.	4 yds.	2 yds., 1 ft.
e.	$4\frac{7}{8}$ cub. ft.	$3\frac{1}{3}$ yds.	$2\frac{1}{4}$ in.

(2) Given volume, area of one face, find the third side:

a.	60 cub. ft.	12 sq. ft.
b.	5 cub. yds., 25 ft.	17 sq. yds., 7 ft.
c.	$8\frac{1}{15}$ cub. yds.	$1\frac{2}{9}$ sq. ft.
d.	$2\frac{1}{4}$ cub. in.	150 sq. yds.

(3) Given volume and one side, find area of one face:

a. 343 cub. yds.	7 yds.
b. 1 cub. yd.	$1\frac{1}{2}$ in.
c. $3\frac{3}{8}$ cub. in.	$\frac{1}{1000}$ in.
d. $1\frac{2}{5}$ cub. ft.	1 yd.

(4) How many bricks are there in a wall, 7 yds., 2 ft., 4 in. long, 2 yds., 2 ft., 3 in. high, 1 ft., $1\frac{1}{2}$ in. thick? A brick is 9 in. long, $4\frac{1}{2}$ in. broad, 3 in. thick.

(5) A pile of stones is 12 yds. long, $4\frac{1}{2}$ yds. broad, 5 ft. high. How many stones are there, each being 1 foot long, $4\frac{1}{2}$ in. broad, 5 in. thick?

(6) How many cubic feet of wood are there in a block of timber, 15 ft., $10\frac{1}{2}$ in. long, 2 ft., $7\frac{1}{2}$ in. broad, and 1 ft., 2 in. thick?

(7) Gold can be beaten out to the thickness of $\frac{1}{200000}$ of an inch. How much surface can a cubic inch of gold be made to cover?

(8) If $\frac{2}{5}$ of a cubic foot of gold is beaten out to cover 1 acre, find its thickness.

(9) Find the value of a mass of timber, 6 yds., 2 ft., 4 in. long, 1 ft., 9 in. broad, 10 in. thick, at $7\frac{3}{4}$*d.* per cubic foot.

(10) Find the area of the reservoir that would contain the daily water supply of London, 83361824 gallons, if each gallon has $277\frac{11}{40}$ cubic inches, supposing it to be 6 feet deep?

(11) Find the cost of lining with tin a cubical box, one edge of which is 4 ft., 6 in., at 1*s.* 6*d.* per square yard.

EXERCISE XXXIV.

Miscellaneous Examples on Vulgar Fractions.

(1) Find the value of:

a. $\frac{15}{28}$ of £2. 13*s.* $1\frac{1}{4}$*d.*

b. $\frac{15}{28}$ of 7 cwt., 3 qrs., 9 lbs.

c. $\frac{15}{28}$ of 2 years, 73 days.

(2) Find the value of $4\frac{4}{9}$ guineas + $3\frac{2}{5}$ of 2*s.* 6*d.* + £$\frac{7}{15}$ − $\frac{3}{5}$ of 1*s.*

(3) Simplify $(7\frac{5}{12} + 6\frac{5}{8}) + (7\frac{5}{12} - 6\frac{5}{8}) + (7\frac{5}{12}$ of $6\frac{5}{8}) - (7\frac{5}{12} \times 6\frac{5}{8}) + (7\frac{5}{12} \div 6\frac{5}{8}) \times (6\frac{5}{8} \div 7\frac{5}{12})$.

(4) Interpret the symbol $\times$, and apply it, where possible, to the following:

a. £7 × 3.	*c.* £7 × 0.	*e.* £$\frac{3}{7}$ × $\frac{5}{9}$.	*g.* $\frac{3}{7}$ × £$\frac{5}{9}$.
b. £7 × 1.	*d.* £$\frac{3}{5}$ × $\frac{1}{2}$.	*f.* £$\frac{5}{9}$ × $\frac{3}{7}$.	*h.* £$\frac{3}{7}$ × £$\frac{5}{9}$.

(5) What fractions of £1 are 13*s.* 8*d.*, 17*s.* 10½*d.*, 2*s.* 3¼*d.*?

(6) Divide $5\frac{3}{8}$ of 2*s.* 6*d.* by $\frac{3}{7}$ of 1*s.*

(7) A can do a piece of work in 4 days, and B in 5 days. In what time will they do it together?

[A in 1 day does $\frac{1}{4}$ of the work;
B „ $\frac{1}{5}$ of the work;
∴ A and B together „ do $\frac{1}{4}+\frac{1}{5}=\frac{9}{20}$ of the work; as many times, then, as $\frac{9}{20}$ of the work is contained in the whole work, so many days will A and B together require. $1 \div \frac{9}{20} = \frac{20}{9} = 2\frac{2}{9}$.]

(8) A can do a piece of work in 12 days, which B can do in 10 and C in 15 days. In what time will all three together do it?

(9) A can do a piece of work in 14 days; B works twice as fast as A, and C can do it in 10 days. In what time can all three together do it?

(10) A can mow 2 acres in 7 days, B can mow 3 acres in 10 days. In what time will the two together mow 1 acre?

(11) A and B together can do a piece of work in 8 days, A alone can do it in 12 days. In what time could B alone do it?

(12) Simplify $\dfrac{\frac{2\frac{1}{2}}{1}+1\frac{2}{3}+\frac{1}{3\frac{1}{2}}}{3\frac{2}{3}-2\frac{1}{4}}$.

(13) Express $\frac{1}{29}$ of 1 lb. troy + $\frac{1}{29}$ of 1 lb. av. both as troy and as av. weights.

(14) Multiply $49\frac{15}{16}$ by $50\frac{1}{16}$, and add $\frac{1}{256}$ to the result.

(15) Reduce $\frac{3503}{4294}$ to lowest terms.

(16) Arrange in descending order of magnitude, $\frac{13}{25}$, $\frac{15}{26}$, $\frac{16}{27}$.

(17) If the step of a man be $2\frac{1}{3}$ feet, and that of a horse $2\frac{3}{4}$ feet, how many horse-paces are equal to 50 man-paces?

(18) Find the smallest exact number of feet which is an exact number of horse-paces and of man-paces.

(19) Find the largest quantity which is contained a whole number of times in each of the following: $2\frac{5}{9}$, $6\frac{7}{18}$, $11\frac{1}{2}$, $19\frac{1}{6}$.

(20) Find the value of $£\frac{1}{1000} + \frac{1}{100}d$.

(21) The area of a certain room is $265\frac{5}{6}$ square feet; its length is $17\frac{3}{8}$ feet. Find its breadth.

(22) The volume of a log of wood is 115 cubic feet; its breadth is $3\frac{3}{8}$ feet; its thickness, $11\frac{1}{2}$ inches. Find the length.

(23) What fraction of 12*s.* 6*d.* must be added to $\frac{5}{7}$ of 1 guinea to make £1?

(24) Multiply the sum of $\frac{2}{3}$ of £100, and $\frac{1}{2\frac{2}{3}}$ of £6. 6*s.* 8*d.*, by $\frac{2}{7}$ of $\frac{\frac{5}{2}+\frac{3}{5}}{1\frac{1}{23}}$.

(25) Find L.C.M. of $\frac{3}{14}$, $1\frac{9}{35}$, $\frac{33}{56}$, $3\frac{20}{63}$.

(26) On Monday I spent $\frac{3}{8}$ of my money, on Tuesday $\frac{2}{5}$ of the original sum, and had then £11. 12*s.* 6*d.* left. How much had I at first?

(27) If on Tuesday I had spent $\frac{2}{3}$ of what was left me from Monday, and had then had £11. 12*s.* 6*d.* left, what would my original sum have been?

(28) Simplify $\frac{2\frac{2}{3}+1\frac{1}{2}}{2\frac{2}{3}-1\frac{1}{2}} \div \frac{5}{8}$.

(29) A person bequeathed $\frac{5}{12}$ of his property to A, $\frac{1}{4}$ of it to B, $\frac{1}{6}$ to C, and $\frac{1}{8}$ to D. The remainder, £550, to charities. What was the value of the whole property?

(30) If 1 bushel last $3\frac{2}{7}$ days, how many days will $4\frac{11}{20}$ bushels last?

(31) Divide the sum of $8\frac{4}{7}$ and $4\frac{4}{9}$ by

a. the sum
b. the difference } of their reciprocals.
c. the product

(32) Machine A can pump 3 gallons in 5 minutes, machine B works half as fast again as A, and C at half B's speed. In what time would A alone pump 1 gallon?

B " 4 gallons?
C " $1\frac{1}{2}$ gallons?
A, B and C together $2\frac{5}{8}$ gallons?

(33) Divide the sum of $\frac{2}{5}$ of $3\frac{3}{10}$, $\frac{1\frac{3}{4}}{2\frac{5}{8}}$ of 17, and $\frac{3}{5}$ of $5\frac{3}{4}$ of $\frac{34}{51}$, by 19.

(34) Simplify $\frac{15}{17}$ of $\frac{6\frac{4}{5}}{2\frac{8}{11}}$ of $(2\frac{7}{9} \div 3\frac{8}{9})$.

(35) Express $\frac{1}{5}$ of 13*s.* 4*d.* as a fraction of £5.

(36) If $\frac{3}{7}$ of an estate be worth £450, what is the worth of $\frac{11}{24}$ of it?

[$\frac{3}{7}$ is worth £450;
1 " $\frac{7}{3}$ of £450;
$\frac{11}{24}$ " $\frac{11}{24} \times \frac{7}{3} \times$ £450.]

(37) A can do a piece of work in 10 days, B can do it in 12 days, and C in 9 days. In what time will all three do $2\frac{1}{2}$ such pieces of work? What share of all the work is done by A, B and C respectively? If £1. 10*s.* 11*d.* is paid per piece of work, how much should each receive for the $2\frac{1}{2}$ pieces?

(38) A man can do a piece of work in 5 days, which a woman would take 8 and a boy 12 days to finish; the man worked $1\frac{1}{4}$ days and was joined by the woman; both together then worked for $1\frac{1}{2}$ days, leaving the remainder to be finished by the boy. How long will he take to complete his task, and which of the three will have done the largest and which the smallest share of the work?

(39) Give three different interpretations to the symbol $\frac{3}{4}$, and apply each to $\frac{4\frac{1}{5}}{6\frac{1}{8}}$.

(40) I had $\frac{2}{3}$ of a ship and sold $\frac{4}{5}$ of this share for £1200. What is the value of the whole ship?

(41) If 220 gals. of creosote, at 1*d.* per gal., give as much heat as $2\frac{1}{2}$ tons of coal, what will be the cost of the quantity of creosote that has the heating power of 1 ton of coal?

(42) The value of an oz. of standard gold is £3. 17*s.* $10\frac{1}{2}$*d.* What fraction of £1000 are 625 oz. of gold?

(43) Find the value of $\frac{2}{3}$ of $\frac{5}{8}$ of $\frac{1}{2\frac{1}{2}}$ of 7 articles, if $\frac{3}{5}$ of $1\frac{3}{4} \times 2\frac{1}{3}$ articles cost £15. 7*s.* 8*d.*?

(44) A cistern of 960 gallons is emptied by two pipes, A and B, in 5 and 7 minutes respectively. How much water will pass through each pipe if both are opened together?

(45) A and B together can do a piece of work in 6 days, A and

C in 8 days, B and C in 9 days. In what time could all three together do it?

(46) A brick is 9 in. long, $4\frac{1}{2}$ in. wide, and 3 in. thick. How many bricks are wanted to build a wall 520 yds., 9 in. long, 15 ft. high and $1\frac{1}{2}$ ft. thick?

(47) What will be the cost of painting the four walls of a room which is 24 ft., 3 in. long, 11 ft., 9 in. broad, and 11 ft., 6 in. high, at 1*s.* 6*d.* per sq. ft.?

(48) Find the average of $21\frac{2}{3}$, $73\frac{4}{5}$, 0, $3\frac{13}{200}$, 82, $17\frac{3}{20}$, $5\frac{1}{4}$, $9\frac{5}{12}$.

(49) If I spend on the first day $\frac{3}{5}$ of my money, next day $\frac{3}{5}$ of what is left, and so on for 4 days, what fraction of the original sum will be left?

(50) By what must the difference between $\frac{51}{65}$ and $\frac{13}{65}$ be

a. increased,
b. multiplied,
c. divided,

to give 12?

(51) Divide 15*s.* 9*d.* by $2\frac{5}{8}$.

(52) Divide 15*s.* 9*d.* by 2*s.* $7\frac{1}{2}$*d.*

(53) Divide 15*s.* 9*d.* by £$2\frac{5}{8}$.

(54) A cistern can be filled by pipes A and B in 5 and 6 minutes respectively, and emptied by C in 4 minutes. In what time will the cistern be filled if all three are opened?

(55) From 1 lb. troy are coined $46\frac{29}{40}$ sovs. Express the weight of 1 sov., both by troy and av. weight.

(56) Simplify $\dfrac{1\frac{13}{20} \times 4 + \frac{2\frac{1}{10}}{1\frac{4}{5}} + \left(\frac{3}{20} \div \frac{3}{22}\right)}{\dfrac{\left(4\frac{1}{5} \times 6\frac{2}{3}\right) + \left(11\frac{1}{5} \times 1\frac{2}{3}\right)}{11\frac{1}{5} \times 6\frac{2}{3}}} \times \dfrac{2\frac{1}{3}}{1\frac{5}{8}}$ of $\dfrac{1\frac{5}{8}}{2\frac{1}{3}}$

(57) Simplify $\dfrac{1}{6 + \frac{1}{7\frac{1}{4}}} + \frac{3}{5}$ of $1\frac{2}{5} + \left(1\frac{2}{7} + 1\frac{1}{4}\right) + \frac{9}{350}$.

(58) The area of a certain floor is $145\frac{1}{2}$ sq. ft.; its length is 15 ft., $4\frac{1}{2}$ in. Find the width.

(59) A court-yard is to be paved with tiles $10\frac{1}{2}$ in. square. How many tiles will be wanted if the court is 7 yds., 2 ft., 4 in. long, and 4 yds., 2 feet wide?

(60) How many tiles would have been wanted if each had an area of $10\frac{1}{2}$ sq. in.?

(61) State and prove the rules for the multiplication and division of one vulgar fraction by another. Shew that the multiplication of two proper fractions will give a product less than either of them.

(62) Simplify

$\alpha.\ \dfrac{m \times a}{b \times m}.$ $\qquad \zeta.\ \dfrac{m \times a + m \times b}{m}.$

$\beta.\ \dfrac{a}{b \times c} + \dfrac{b}{c \times a} + \dfrac{c}{b \times a}.$ $\qquad \eta.\ \dfrac{1}{a + \frac{1}{b}}.$

$\gamma.\ \dfrac{a}{b} \times \dfrac{c}{d}.$ $\qquad \theta.\ \left(\dfrac{a}{b} + \dfrac{c}{d}\right) \times b.$

$\delta.\ \dfrac{a}{b} \div \dfrac{c}{d}.$ $\qquad \iota.\ \left(\dfrac{a}{b} - \dfrac{c}{d}\right) \times d.$

$\epsilon.\ \dfrac{a}{b} \times \dfrac{c}{d} \times b \times d.$ $\qquad \kappa.\ \left(\dfrac{a}{b} \pm \dfrac{c}{d}\right) \times b \times d.$

(63) Simplify $\dfrac{\frac{27}{64} - \frac{8}{27}}{\frac{9}{16} + \frac{1}{2} + \frac{4}{9}} + \dfrac{4\frac{1}{7} - 2\frac{1}{4}}{6\frac{1}{2} - 2\frac{1}{7}}.$

(64) Divide 1 lb. troy and also 1 lb. avoirdupois by 17 lb. 10 oz., 6 dwts., 15 grs. troy.

(65) A room is 8 yds., 2 ft., 3 in. long, and 5 yds., 9 in. broad. Find the cost of covering it with carpet $\frac{3}{4}$ yd. wide, at 4*s.* 6*d.* a yd.

(66) If the value of one rupee is $1\frac{23}{24}$*s.* how many rupees can be bought for £$7\frac{14}{15}$?

(67) If 56 cubic feet, 1044 cubic inches, of timber are required to floor a room $29\frac{1}{4}$ feet long, and $25\frac{1}{3}$ feet wide, what is the thickness of the boards?

(68) Find the fraction of £1 which is equivalent to the excess of $\frac{2}{3}$ of a guinea above the sum of $\frac{3}{4}$ of 1*s.* and $\frac{4}{9}$ of 7*s.* 6*d.*

(69) The cargo of a ship worth £45000 belongs to three partners; A owns $\frac{7}{9}$ of $\frac{3}{5}$ of it; B's share is equal to $3\frac{3}{14}$ times $\frac{2}{9}$ of A's share, and C owns the remainder. What part of the cargo is owned by each partner, and what ought each to receive from the sale?

(70) If the circumference of a wheel is $3\frac{1}{7}$ times its diameter, how many times will a wheel 1 yd., $1\frac{1}{8}$ ft. in diameter, revolve in travelling $3\frac{3}{7}$ miles?

EXERCISE XXXV.

(1) 371 × 2*s.*
(2) 8643 × 2*s.*
(3) 615 × 2*s.*
(4) 8497 × 2*s.*
(5) 1729 × 2*s.*
(6) 4572 × 2*s.*
(7) 9724 × 2*s.*
(8) 1376 × 2*s.*
(9) 7948 × 2*s.*
(10) 320 × 2*s.*

EXERCISE XXXVI.

(1) 4378 × 12*s.*
(2) 987 × 14*s.*
(3) 6716 × 16*s.*
(4) 3545 × 18*s.*
(5) 3714 × 8*s.*
(6) 7341 × 4*s.*
(7) 8267 × 6*s.*
(8) 9752 × 8*s.*
(9) 723 × 12*s.*
(10) 8769 × 10*s.*

EXERCISE XXXVII.

(1) 9802 × 1*s.*
(2) 8491 × 1*s.*
(3) 4624 × 1*s.*
(4) 3765 × 1*s.*
(5) 537 × 1*s.*
(6) 1280 × 1*s.*
(7) 1579 × 1*s.*
(8) 658 × 1*s.*
(9) 713 × 1*s.*
(10) 5046 × 1*s.*

EXERCISE XXXVIII.

(1) 4253 × 3*s.*
(2) 8674 × 7*s.*
(3) 2587 × 9*s.*
(4) 483 × 13*s.*
(5) 5724 × 17*s.*
(6) 3048 × 19*s.*
(7) 956 × 11*s.*
(8) 5010 × 17*s.*
(9) 3466 × 19*s.*
(10) 8888 × 3*s.*

EXERCISE XXXIX.

(1) 846 × 10*s.*
(2) 789 × 4*s.*
(3) 8736 × 2*s.* 6*d.*
(4) 1234 × 1*s.* 8*d.*
(5) 477 × 3*s.* 4*d.*
(6) 3124 × 5*s.*
(7) 385 × 6*s.* 8*d.*
(8) 4457 × 2*s.* 6*d.*

(9) 1494 × 3*s.* 4*d.*
(10) 779 × 6*s.* 8*d.*
(11) 387 × 10*s.*
(12) 7773 × 2*s.* 6*d.*
(13) 765 × 1*s.* 8*d.*
(14) 1452 × 2*s.* 6*d.*
(15) 17 × 10*s.*
(16) 2831 × 5*s.*
(17) 43 × 6*s.* 8*d.*
(18) 787 × 3*s.* 4*d.*
(19) 29 × 5*s.*
(20) 76047 × 3*s.* 4*d.*
(21) 451 × 2*s.* 6*d.*
(22) 4284 × 6*s.* 8*d.*
(23) 2318 × 5*s.*
(24) 51 × 4*s.*
(25) 1717 × 5*s.*
(26) 11 × 3*s.* 4*d.*
(27) 1837 × 4*s.*
(28) 2655 × 3*s.* 4*d.*
(29) 2470 × 2*s.* 6*d.*
(30) 4776 × 1*s.* 8*d.*
(31) 38 × 2*s.* 6*d.*
(32) 588 × 1*s.* 8*d.*
(33) 848 × 3*s.* 4*d.*
(34) 3786 × 2*s.* 6*d.*
(35) 567 × 2*s.* 6*d.*
(36) 11111 × 1*s.* 8*d.*

EXERCISE XL.

(1) 5430 × 8*d.*
(2) 5124 × 2*d.*
(3) 1524 × 6*d.*
(4) 1740 × 6*d.*
(5) 3432 × 4*d.*
(6) 41296 × 3*d.*
(7) 3456 × 8*d.*
(8) 26413 × 2*d.*
(9) 5899 × 6*d.*
(10) 4106 × 3*d.*
(11) 2745 × 4*d.*
(12) 12113 × 3*d.*
(13) 5468 × 2*d.*
(14) 6794 × 8*d.*
(15) 8142 × 6*d.*
(16) 8182 × 2*d.*
(17) 4533 × 6*d.*
(18) 2330 × 4*d.*
(19) 6658 × 8*d.*
(20) 4507 × 4*d.*
(21) 8155 × 3*d.*
(22) 7346 × 6*d.*
(23) 3751 × 2*d.*
(24) 4414 × 4*d.*
(25) 9255 × 3*d.*
(26) 7646 × 8*d.*
(27) 5273 × 2*d.*
(28) 2851 × 8*d.*
(29) 7108 × 3*d.*
(30) 6498 × 2*d.*
(31) 2537 × 4*d.*
(32) 9059 × 6*d.*
(33) 1439 × 2*d.*
(34) 3413 × 6*d.*
(35) 17222 × 3*d.*
(36) 21329 × 3*d.*

Exercise XLI.

		£.	s.	d.			£.	s.	d.
(1)	7000 @	5	10	0	(14)	7235 @	10	16	$7\frac{1}{4}$
(2)	394	1	18	0	(15)	586	4	4	$4\frac{1}{2}$
(3)	1776	4	17	6	(16)	725	0	12	$11\frac{1}{2}$
(4)	3458	2	13	4	(17)	678	0	9	$2\frac{1}{4}$
(5)	43728	8	18	6	(18)	965	3	2	$5\frac{1}{2}$
(6)	4639	1	17	3	(19)	132	7	3	$8\frac{3}{4}$
(7)	529	4	8	$7\frac{1}{2}$	(20)	854	0	5	3
(8)	7641	3	7	$11\frac{3}{4}$	(21)	720	11	10	$7\frac{1}{4}$
(9)	82465	0	13	$9\frac{1}{4}$	(22)	37	10	6	$8\frac{1}{2}$
(10)	8762	10	1	$1\frac{1}{4}$	(23)	256	20	11	$4\frac{3}{4}$
(11)	385	5	7	$6\frac{3}{4}$	(24)	749	40	14	6
(12)	1044	3	19	$10\frac{1}{2}$	(25)	365	0	15	$5\frac{1}{4}$
(13)	157	6	18	$9\frac{3}{4}$	(26)	1870	8	14	$9\frac{1}{2}$

(27) Taking a year to be 365 days, find the wages for a year, if the daily wages be 1*s.*, 4*s.* 6*d.*, 7*s.* 4*d.*, £1. 2*s.* 6*d.*, £3. 4*s.* 10*d.*

Exercise XLII.

(1) $426\frac{1}{2} \times$ £8. 4*s.* $3\frac{1}{2}$*d.*
(2) $712\frac{2}{3} \times$ £5. 7*s.* 4*d.*
(3) $28\frac{15}{16} \times$ £20. 4*s.* 4*d.*
(4) $537\frac{7}{11} \times$ £33. 4*s.* 9*d.*
(5) $821\frac{5}{8} \times$ £7. 10*s.* $3\frac{3}{4}$*d.*
(6) $246\frac{7}{20} \times$ £14. 4*s.* $4\frac{1}{4}$*d.*

Exercise XLIII.

(1) 7 tons, 5 cwt., 1 qr., 21 lbs. at £10. 4*s.* per ton.
(2) 11 cwt., 3 qrs., 14 lbs. at £8. 10*s.* per ton.
(3) 4 cwt., 1 qr., 17 lbs. at £3. 3*s.* per cwt.
(4) 4 oz., 11 dwt., 17 grs. at £5. 10*s.* per oz.
(5) 14 miles, 2 fur., 143 yds. at £42 per mile.
(6) 3 qrs., 19 lbs. at £7. 8*s.* 4*d.* per cwt.
(7) 4 hours, 17 min., 17 sec. at 45 miles per hour.
(8) 11 tons, 11 cwt., 23 lbs. at £3. 19*s.* per ton.
(9) 4 oz., 7 dwts., 11 grs. at £3. 17*s.* $10\frac{1}{2}$*d.* per oz.
(10) 23 lbs., 14 oz. av. at £18. 10*s.* per cwt.

EXERCISE XLIV.

(1) 421 tons, 11 cwt. at £5. 12*s*. 6*d*. per ton.
(2) 75 tons, 9 cwt., 1 qr. at £12. 10*s*. 6*d*. per ton.
(3) 137 oz., 12 dwt. at £3. 17*s*. $10\frac{1}{2}$*d*. per oz.
(4) 511 miles, 5 fur., 77 yds. at £417. 18*s*. 9*d*. per mile.
(5) 4*s*. $10\frac{1}{2}$*d*. in the £ on £5811. 17*s*. 6*d*.
(6) 71 days (of 12 hrs.), $9\frac{1}{2}$ hrs. at £7. 7*s*. a day.
(7) 111 yds., 1 ft., 1 in. at 5*s*. $6\frac{1}{2}$*d*. per yd.
(8) 5*s*. $4\frac{3}{4}$*d*. in the £ on £826. 14*s*. 10*d*.
(9) 37 cwt., 3 qrs., 24 lbs. at £10. 12*s*. 8*d*. per cwt.
(10) 76 gals., 3 qts., 1 pt. at 14*s*. 9*d*. per gal.
(11) 23 years, 17 weeks, at £10. 10*s*. a year.
(12) Find the price of 14 ingots of gold, each weighing 3 lbs., 7 oz., 14 dwts., 21 grs. at £3. 17*s*. $10\frac{1}{2}$*d*. per oz.
(13) 3 cwt., 2 qrs., 16 lbs. at £3. 7*s*. 8*d*. per cwt.
(14) 3 acres, 1 rood, 14 poles, at £125 per acre.
(15) 15 silver plates, each weighing 7 oz., 11 dwts., 6 grs. at 6*s*. 8*d*. per oz.

EXERCISE XLV.

What quantity is the same fraction

(1)	of 20	that 4	is of 5?
(2)	„ 35	„ 6	„ 15?
(3)	„ 35	„ 15	„ 6?
(4)	„ $2\frac{3}{4}$	„ $1\frac{1}{2}$	„ $1\frac{3}{4}$?
(5)	„ $10\frac{4}{5}$	„ $1\frac{4}{5}$	„ 2?
(6)	„ $10\frac{4}{5}$	„ $10\frac{4}{5}$	„ 11?
(7)	„ £2. 10*s*. 8*d*.	„ 3	„ 4?
(8)	„ £10. 10*s*.	„ 1 cwt., 3 qrs.	„ 2 cwt., 2 qrs.?
(9)	„ £8. 7*s*. 6*d*.	„ 2 yrs., 73 d.	„ $3\frac{1}{2}$ yrs.?
(10)	„ 1 oz. troy	„ 1*s*.	„ £1?
(11)	„ 1 oz. troy	„ 1*d*.	„ £1?
(12)	„ 1 lb. troy	„ 1*s*.	„ £1?

What quantity is the same fraction

(13)	of £1	that 1 oz.	is of 1 lb. troy?
(14)	„ £1	„ 1 dwt.	„ 1 lb. troy?
(15)	„ £1	„ 1 qr.	„ 1 ton?
(16)	„ £1	„ 1 fur.	„ 1 mile?
(17)	„ 2*s.* 6*d.*	„ 1 pole	„ 1 furlong?
(18)	„ £1. 1*s.*	„ $6\frac{2}{3}$ yds.	„ $3\frac{4}{5}$ furlongs?
(19)	„ $\frac{1}{4\frac{2}{7}}$	„ $3 \times 1\frac{2}{7}$	„ $6 \times 1\frac{2}{7}$?
(20)	„ the reciprocal of 10	„ 11	„ its reciprocal?
(21)	„ 1000 sheep	„ 3 men	„ 5 men?

Exercise XLVI.

(1) Break up 60 into two pairs of factors, and write down the resulting eight proportional arrangements.

(2) Do the same with 15, 21, 25, 100, $2\frac{5}{8}$.

Exercise XLVII.

I. State the following proportion in the eight different ways and find the value of x from each way. $x : 10 = 12 : 15$.

II. Find the value of x from the following:

(1) $x : 2 = 3 : 4$.
(2) $2 : x = 3 : 4$.
(3) $2\frac{1}{2} : 3\frac{1}{2} = x : 4\frac{1}{2}$.
(4) $5\frac{1}{4} : 1 = 3 : x$.
(5) $4 : 5 = 5 : x$.
(6) $\frac{1}{2\frac{1}{2}} : x = \frac{1}{3\frac{1}{2}} : \frac{1}{2\frac{1}{2}+3\frac{1}{2}}$.
(7) $\frac{1}{\frac{2+1}{3\frac{1}{4}}} : \frac{13}{30} = x : 1$.
(8) $x : \frac{1}{\frac{4+1}{5+1}} = \frac{1}{\frac{6+1}{5+1}} : 21\frac{7}{10}$.

III. Place x in the first, second, third and fourth terms successively, and find its value in each case, the other three terms being:

(1) 12, 15, 20.
(2) 1, 2, 3.
(3) $3\frac{1}{3}$, $3\frac{3}{4}$, $2\frac{6}{7}$.
(4) $(\frac{1}{4}-\frac{1}{6})$, $(\frac{1}{4}+\frac{1}{6})$, $(\frac{1}{2}-\frac{1}{6})$.

EXERCISE XLVIII.

(1) Find the cost of 72 articles, if 40 cost £3. 12*s.* 8½*d.*

(2) If 15 sacks of potatoes cost £4. 4*s.*, what shall we pay for 50 sacks?

(3) What is the cost of 104 yards at £1. 11*s.* 6*d.* for 91 yards?

(4) What will be the weekly keep of 195 horses, if 117 horses can be kept for £46. 16*s.* 9*d.*?

(5) What will be the carriage for 161 miles at 18*s.* 6*d.* for 276 miles?

(6) How many articles can be bought for £15, if 10 cost £25?

(7) If 15 sacks of potatoes cost £4. 4*s.*, how many can be bought for £2. 12*s.* 6*d.*?

(8) How many yards can be bought for £33. 6*s.* 8*d.* at £100 for 300 yards?

(9) If 45 yards of trench are dug by 15 men, how many men would be required to dig in the same time 63 yards?

(10) If a railway ticket for 125 miles cost 7*s.* 9¾*d.*, how far ought I to be able to travel for £3. 2*s.* 6*d.*?

(11) Find the cost of 4 tons, 17 cwt., 3 qrs., if 11 cwt., 2 qrs. cost 19*s.* 10½*d.*

(12) Gold costs £3. 17*s.* 10½*d.* per oz. troy. Find the value of 1 lb., 2 oz., 11 dwts., 16 grs. troy.

(13) How many oz. troy of gold shall I get for £103. 16*s.* 8*d.*?

(14) Find the wages for 2 years, 8 months, at £10. 15*s.* per annum.

(15) A and B divide between them a hogshead of claret (23 dozen), costing £34. 10*s.* A takes 150 bottles. How much has B to pay?

(16) If 3 qrs., 5 lbs. cost 3*s.* 8½*d.*, what will 2½ cwt. cost?

(17) How long will £368. 19*s.* 1*d.* keep me, if £96. 0*s.* 7*d.* suffices from March 17 to June 20?

(18) How much old brandy can I get for £1. 17*s.* 6*d.* at £3 per gallon?

(19) Taking the diameter of the earth at 7917 miles, and the highest mountain at 29,000 feet, by what fraction of an inch ought this mountain to be represented on a globe 1 yard in diameter?

(20) If 6 cwt., 1 qr., 21 lbs., cost £5. 9*s.* $5\frac{1}{4}$*d.*, what weight can be bought for £17. 17*s.*?

(21) $4\frac{7}{8}$ articles cost 9*s.* 10*d.* Find the cost of $10\frac{4}{5}$ articles.

(22) How many articles can be bought for 17*s.* $4\frac{1}{2}$*d.*, if $8\frac{4}{7}$ articles are bought for 2*s.* $2\frac{2}{5}$*d.*?

(23) A owns $\frac{5}{16}$ of a ship, B owns $\frac{5}{12}$ of it. If A's share is worth £2950, what is B's worth?

(24) If for £1700 I buy $\frac{9}{10}$ of a ship, what fraction of it can I buy for 1270 guineas?

(25) Find the fourth proportional to $4\frac{3}{8}$, $5\frac{2}{5}$, $7\frac{11}{12}$ [i.e. place x in the fourth term].

(26) The value of a fraction is $\frac{19}{20}$, the numerator is $33\frac{5}{8}$. What must the denominator be?

Exercise XLIX.

(1) If 8 men can mow a field in 5 days, how many men will mow it in 2 days?

(2) If 8 men can mow a field in 5 days, how many days will 10 men require?

(3) If we require $75\frac{3}{4}$ yds. of carpet $\frac{3}{4}$ yds. wide, to cover a room, how many yards of carpet $1\frac{1}{8}$ yds. wide, will be required?

(4) If £483 gain £27. 15*s.* interest in 1 year, how much capital will make the same profit in $7\frac{1}{2}$ months?

(5) If with a given sum of money I can buy 112 dozen at 7*s.* $4\frac{1}{2}$*d.* per dozen, how many articles can I buy at 10*s.* 6*d.* per dozen?

(6) If the wages of an Austrian workman be 1*s.* 8*d.* a day, and of a Lancashire workman 4*s.*, how many of the former can be hired for the wages of 375 of the latter?

(7) What sum of money will at $3\frac{1}{2}$ per cent. yield the same interest that 400 guineas yield at 5 per cent.?

(8) The capital of a company is raised by the issue of 1750 shares at £45 each. What would be the value of each share if 3000 shares had been issued to raise the same amount?

(9) If 6352 stones, 3 ft. long, are required for a certain wall, how many stones, 2 ft. long, will be wanted?

(10) What length of land must be cut off from a piece $13\frac{1}{2}$ poles wide, to contain an area equal to a field 88 yds. long and 55 yds. broad?

(11) If $6\frac{2}{3}$ bushels last $1\frac{7}{8}$ days, how many days will $14\frac{2}{9}$ bushels last?

(12) If the daily allowance is $6\frac{2}{3}$ bushels, the store will last $1\frac{7}{8}$ days. How long will the store last with a daily allowance of $14\frac{2}{9}$ bushels?

Exercise L.

(1) Find the cost of 72 yds. at the rate of £5. 12*s.* 6*d.* for 10 yds.

(2) If $7\frac{1}{4}$ cwt. cost £26. 10*s.* 4*d.*, what will $43\frac{1}{2}$ cwt. cost?

(3) If 3 paces are equal to 2 yds., how many paces will there be in $106\frac{2}{3}$ yds.?

(4) If 5 balls of lead weigh as much as 9 of iron, and 7 of marble as much as 3 of iron, how many balls of marble will equal in weight 35 balls of lead?

(5) If 1 dollar is worth 4*s.* $1\frac{1}{2}$*d.*, and also 5 fr., 17 centimes, find the value of a franc in sterling money (1 fr. = 100 centimes).

(6) How many francs are worth £1, if $49\frac{1}{2}$*d.* buy one dollar, and 100 dollars fetch 517 fr.?

(7) Find the value of the wool from 14,000,000 sheep, at £8. 16*s.* per cwt., if 11 sheep yield 25 lbs. of wool.

(8) How many francs for £1, if 35 Flemish shillings = £1, 480 rees are worth 3 francs, and 400 rees are worth $3\frac{1}{2}$ Flemish shillings?

(9) If the rent of land in France be 140 francs per hectare, calculate the rate per acre in English money, 25 francs being equal to £1, and 100 hectares to 247 acres.

(10) If 1 metre = $39\frac{37}{100}$ in. and £1 = $25\frac{3}{8}$ fr., what is the cost in English money of 1 yd. at $1\frac{9}{20}$ fr. per metre?

(11) If $11\frac{11}{20}$ Dutch florins are given for $24\frac{9}{10}$ francs, 385 florins for 442 marks Hambro', and $68\frac{1}{4}$ marks for 32 Russian roubles, how much English money should be given for 2010 roubles at $25\frac{1}{8}$ fr. per £1?

(12) If 3 lbs. of tea are worth 4 lbs. of coffee, and 6 lbs. of coffee are worth 20 lbs. of sugar, how many lbs. of sugar can be had for 9 lbs. of tea?

(13) The day's journey in Turkey being 10 hours of $4\frac{1}{2}$ English miles each, and 11 English miles being equal to 12 Roman miles, how many Roman miles are there in 13 days' journey in Turkey?

(14) If £3 = 20 thalers, 25 gulden = 62 francs, 25 thalers = 93 francs; find how many gulden are equal to £1 sterling.

(15) If £1 = $25\frac{1}{2}$ francs, $9\frac{1}{3}$ florins = 20 francs, how many florins for £1?

(16) How much capillaire must be added to 580 gallons of dry gin, if to 100 gals. of gin is put 45 lbs. of sugar, and 1 gallon of capillaire has the sweetening power of 13 lbs. of sugar?

(17) Find the cost of 30 pieces of lead, each weighing 1 cwt., 12 lbs., at 16*s.* 4*d.* per cwt.

Exercise LI.

(1) A person takes 2 paces to walk 3 yds. How many yds. will he get over in 250 paces?

(2) How many paces will he take in a mile?

(3) The clothing of a regiment of 750 soldiers amounts to £2831. 5*s.* What will the clothing of 3500 men cost?

(4) A bankrupt owes £1954, his assets are £840. 12*s.* $6\frac{1}{2}$*d.* What will a creditor for £153 recover?

(5) The circumference of the earth at the equator is 24,900 miles. At what rate per hour is a person there carried round, one whole rotation being made in 23 h., 56 min.?

(6) If the 6*d.* loaf weighs 4 lbs. when flour costs £3. 5*s.* a sack, what ought it to weigh if flour cost £2. 15*s.* a sack?

(7) If the 4 lb. loaf cost 6*d.* when flour is £3. 5*s.* a sack, what ought it to cost when flour is £2. 15*s.* a sack?

(8) If the 6*d.* loaf weighs 4 lbs., what ought the $8\frac{1}{2}$*d.* loaf to weigh?

(9) If in a picture a tree 33 feet high is represented by a drawing $1\frac{1}{2}$ inches high, what should represent the height of a house 45 feet high?

(10) How high must a shrub be which is represented in the picture by $\frac{3}{7}$ inch?

(11) If a country 630 miles long is represented in a raised map by a length of $5\frac{1}{2}$ feet, how high ought a mountain of 15,750 feet to be represented on the map?

(12) If $1\frac{1}{2}$ inches represent the distance of the moon from the earth, how far off should the sun be placed, the actual distances being taken as 238,793 and 95,517,200 miles respectively?

(13) If $1\frac{1}{2}$ inches represent the distance of the sun from the earth, how far off should the nearest fixed star be placed, its distance being taken as 20,185,649,876,000 miles?

(14) If light takes 8 min., 13 secs. to travel from the sun to the earth, how long will it take from the moon to the earth, and how long from the star?

(15) The area of a certain garden is $1\frac{1}{2}$ acres, the width being 425 ft. What will its area be if the width be made 510 ft.?

(16) A certain garden is 440 feet long and 100 ft. broad. What would be the breadth of a garden of the same size whose length was 363 ft.?

(17) Find the cost of 7 tons, 12 cwt., 3 qrs., at £1. 10*s.* 10*d.* for 3 cwt., 1 qr.

(18) Find the cost of a tankard, weighing 1 lb., 7 oz., 14 dwts., at £1. 14*s.* 10*d.* for $5\frac{1}{2}$ oz.

(19) If the carriage of 15 tons, 15 cwt., cost £1. 12*s.* 6*d.*, what will be the charge for carrying 3 tons, 17 cwt.?

(20) If 15*s.* 9*d.* pays the carriage on 2 tons, 17 cwt., what weight can be carried for a guinea?

(21) If goods are carried 45 miles for 7*s.* 6*d.*, how far ought they to be carried for 10*s.* 6*d.*?

(22) If for a certain payment 15 tons, 10 cwt. are carried over 100 miles, how far ought 4 tons, 13 cwt. to be carried?

(23) If for a certain payment 10 tons, 9 cwt. are carried 150 miles, what weight ought to be carried over 200 miles?

(24) If from every £92. 10*s.* of capital I obtain £3 income, how much shall I obtain from £740?

(25) A bankrupt pays 9*s.* $4\frac{1}{2}$*d.* in the £. What will be lost on a debt of £324. 13*s.* 4*d.*?

(26) My gross income is £730. 15*s.* What will be left me after paying 5*d.* in the £ income-tax?

(27) Find a fourth proportional to:

a. 6, 9, 10.	*d.* $\frac{1}{7}$ of $\frac{1}{3}$, $\frac{1}{4}$ of $\frac{1}{5}$, $\frac{1}{7}$ of $\frac{1}{8}$.
b. 7, 8, 9.	*e.* $(\frac{2}{3}+\frac{1}{2})$, $(\frac{2}{3}-\frac{1}{2})$, $\frac{2}{3}$ of $\frac{1}{2}$.
c. $2\frac{1}{2}$, $3\frac{1}{3}$, $1\frac{7}{8}$.	*f.* $\frac{1}{2\frac{1}{3}}$, $\frac{1}{3\frac{1}{2}}$, $\frac{1}{4\frac{1}{4}}$.

(28) Find the cost of 2 tons, 7 cwt., 3 qrs., at £5. 18*s.* for 15 cwt., 1 qr.

(29) Find the cost of 73 yds., 1 qr., 3 nls., at £39. 11*s.* 8*d.* for 1000 yds.

(30) If $1\frac{7}{8}$ articles cost £$5\frac{1}{16}$, how much will $2\frac{13}{16}$ articles cost?

(31) If £$\frac{2}{7}$ buy $\frac{5}{7}$ of 1 article, what will £$2\frac{2}{5}$ buy?

(32) A train goes from London to Bristol in $3\frac{1}{3}$ hours, travelling at the rate of 3 miles in 5 minutes. (1) How far is it to Bristol? (2) How long would it take to Exeter (194 miles) at the same rate? (3) How long will it take to Bristol and to Exeter if the rate be increased to 40 miles an hour?

(33) If 770 gallons of creosote have the heating power of $8\frac{3}{4}$ tons of coal, how many gallons a day would be required for a steamer which consumes 50 tons of coal daily?

(34) Find the cost of 1 lb. avoirdupois of gold, at £3. 17*s.* $10\frac{1}{2}$*d.* per oz. troy.

(35) Find the weight of 4361 sovereigns in av. weight at the same rate.

(36) 10 cubic inches of gold weigh as much as 193 cubic inches of water. What is the size of a nugget weighing as much as a cubic foot of water?

(37) If $4\frac{1}{2}$ tons of coal fill a cellar 9 ft. long, 5 ft. broad, 5 ft. high, what space will be required for the coal of a steamer carrying 3 weeks' consumption, at 20 tons per day?

(38) The space between the freezing and the boiling points of water is divided into 180, 80, 100 degrees respectively on Fahrenheit's, Réaumur's and the Centigrade thermometers. How many degrees of the second and third are equivalent to 18, 27, 45 and 63 degrees on the first?

(39) In Fahrenheit's thermometer freezing point is marked 32^0; on the others, zero; so that 32^0 F $= 0^0$ C $= 0^0$ R. Translate the following readings into readings of the other two: 41^0 F; 8^0 R; 40^0 C; 40^0 R; 90^0 C; 86^0 F; 0^0 C; 100^0 C; 100^0 F; 50^0 C; 50^0 F; 50^0 R.

(40) 90 degrees are 100 grades. How many grades are equal to $65\frac{3}{8}$ degrees, and how many degrees are equal to $65\frac{3}{8}$ grades?

(41) If 600 men can dig a cutting 750 yards long in 23 days, how long would 460 men take?

(42) How long would the 600 men take if the cutting were 800 yards long?

(43) What part of the 800 yards would $\frac{4}{5}$ of the number of men do?

(44) How long would $\frac{4}{5}$ of the men take to do the 800 yards?

(45) How many men would it take to do the 750 yards in $\frac{4}{5}$ of the time?

(46) If 24 men dig a ditch in 3 days, how long would they take to dig a ditch half as long again, half as deep again, and half as broad again?

(47) How many men would it take to dig the second ditch in the same time?

(48) What will be my new expenditure, supposing it to have been originally 300 guineas, if I alter it in the ratio of 7 to 12?

(49) If brickwork, 84 ft. high, $73\frac{1}{2}$ ft. long, cost £700, how must I reduce the thickness so that it may cost only £600? What reduction of height would have given me the same result? What would be the cost if both height and length were thus reduced?

(50) If 3 cwt., 2 qrs., 12 lbs. cost £9, what is the price of 6 lbs.?

(51) A bankrupt's debts amount to £4586. 8*s.*, and his effects to 3822 guineas. How much will a creditor receive on a debt of £700?

(52) A railway train travels $\frac{1}{4}$ of a mile in 18 seconds. How many miles an hour does it travel at this rate?

(53) If $35\frac{1}{2}$ lbs. of sugar cost £1. 2*s.* $2\frac{1}{4}$*d.*, how much will 2 cwt., 1 qr., 23 lbs. cost?

(54) If £100 put out to interest for 9 months becomes £103, what sum would amount to £193. 2*s.* 6*d.* in the same time?

(55) If $\frac{1}{143}$ of $3\frac{2}{3}$ of $\frac{7}{9}$ of $5\frac{1}{5}$ of 22 lbs. of sugar cost $8\frac{1}{4}$*d.*, how much will 1 ton, 11 cwt., 3 qrs. cost?

(56) If $\frac{3}{11}$ of $\frac{3}{2\frac{1}{2}}$ of $\frac{5}{27}$ of a ship cost £3710, what part of the ship can be bought for £100?

(57) If a garrison of 1500 men have provisions for 13 months, how long will their provisions last if it be increased by 700 men?

(58) If a man's step be 2 ft., 4 in., and a horse's 2 ft., 9 in., how many steps of the horse are equal to 108 steps of the man?

(59) If 432 and 750 be two among several factors of a number, what must I substitute for the latter if the former be altered to 540, in order that the final product may remain the same?

(60) A coat requiring $2\frac{3}{4}$ yards of cloth, $1\frac{1}{4}$ yds. wide, is lined with silk 39 in. wide. How many yards of silk will be required?

(61) If the quotient be altered from 730 to 219, what must the dividend be, which was before 1,000,000, so that the divisor may be unaltered?

EXERCISE LII.

(1) If £240 be the wages of 6 men for 21 weeks, what will 28 men earn in 23 weeks?

(2) How many men can I employ for 7 months for £453. 12*s.*, if the wages of 50 men for 12 months is £1080?

(3) If I pay £$1\frac{3}{4}$ to 13 men for $3\frac{3}{4}$ days, what will be the wages of 30 men for $10\frac{2}{5}$ days?

(4) If 36 persons consume 240 pecks of corn in 30 days, how long will 100 pecks last 90 persons?

(5) If 15 pumps, working 8 hours a day, can raise 1260 tons of water in 7 days, how many pumps, working 12 hours a day, will be required to raise 7560 tons of water in 14 days?

(6) If 24,000 yds. of cotton cloth, $1\frac{3}{4}$ yds. wide, be worth £400 when raw cotton is at $4\frac{1}{2}d.$ per lb., what is the value of 12,600 yds. of cotton cloth, $1\frac{1}{4}$ yds. wide, when raw cotton is at $9\frac{9}{16}d.$ per lb., supposing the cost of manufacture to have risen in equal proportion?

(7) If the corn of 13 horses for 63 days cost £17. 6*s.* 8*d.* when corn is 4*s.* per bushel, how many horses will in 56 days consume corn to the value of £10. 13*s.* 4*d.* when corn is 4*s.* 6*d.* per bushel?

(8) If 48 pioneers in 5 days, of $12\frac{1}{2}$ hours each, can dig a trench $139\frac{3}{4}$ yds. long, $4\frac{1}{2}$ yds. wide and $2\frac{1}{2}$ yds. deep, how many hours per day must 360 pioneers work during 42 days to dig a trench $4910\frac{1}{16}$ yds. long, $4\frac{7}{8}$ yds. wide and $3\frac{1}{5}$ yds. deep?

(9) If 6 men can perform a piece of work in 12 days of 10 hours each, how many men will perform a piece of work four times as large in a fifth of the time, if they work the same number of hours a day, supposing that 2 of the second set can do as much work in an hour as 3 of the first set?

(10) What is the interest on £100 for 1 year, if the interest on £1303. 6*s.* 8*d.* for 10 years is £488. 15*s.*?

(11) If a block of marble be worth £50, what will be the value of a block twice as long, 3 times as broad, and $\frac{1}{4}$ of the thickness?

(12) If a cubic block cost £50, what would be the price of a cubic block 3 times as long?

(13) If a block of marble weigh 50 cwt., what is the weight of a block of iron, the dimensions of which are to those of the former in the proportion of 2 : 3, 3 : 4, and 4 : 5 respectively, weights of equal blocks of iron and marble being in the propertion of 77 : 27?

EXERCISE LIII.

(1) Divide £3. 10*s.* into two parts which shall have the ratio of 5 : 7.

(2) Divide a guinea into three parts in the ratio of 2 : 3 : 4.

(3) Divide a guinea into 6 parts which shall have the ratios of the first 6 natural numbers.

(4) Two partners engage in business with capitals of £7000 and £9000 respectively, the profits amounting to £2400 a year. What should each receive?

(5) What is the value of the gold in a chain weighing 3 oz., 4 dwt. troy, supposing it to be 18 carats fine (i.e. 18 parts pure gold out of 24) at £3. 17*s.* $10\frac{1}{2}$*d.* per oz.?

(6) If two partners engage in business, investing respectively £482. 1*s.* 8*d.* and £630. 8*s.* 4*d.*, what should each have of a profit of £51. 17*s.* 6*d.*?

(7) Four persons, A, B, C, D, rent a pasture for £57; A put in 8 cattle, B 9, C 10, and D 11. How much should each pay for his share?

(8) A tax of £489. 17*s.* is to be raised from 3 towns, the populations of which are respectively 2500, 3000 and 4200. How much should each town pay?

(9) 40 gallons of alcohol are mixed with 14 gallons of water. What weight of alcohol is there in every lb. weight of the mixture, the weights of equal measures of alcohol and water being in the ratio 4 : 5?

(10) Copper is $8\frac{9}{10}$, tin $7\frac{3}{10}$ times as heavy as water. If 20 cubic inches of tin be mixed with 30 inches of copper, how many times as much as its own bulk of water will the mixture weigh?

(11) Four merchants, A, B, C, D, trade together. A's capital of £800 was in trade 8 months; B's of £700, 12 months; C's of £400, 6 months; and D's of £135, 4 months. What share of the profit should each receive?

(12) If 200 oz. of gold, 18 carats fine, are mixed with 128 oz., 15 carats fine, what is the weight of gold in the mixture?

(13) What is the fineness?

(14) Gunpowder contains $\frac{3}{4}$ of its weight of saltpetre; saltpetre is composed of 39 parts by weight of potassium, 14 of nitrogen and 48 of oxygen. How many lbs. of potassium are there in 909 lbs. of gunpowder?

(15) Divide £250 among A, B, C and D, so that A's share shall be to B's as 4 to 5, B's to C's as 5 to 6, C's to D's as 6 to 7.

(16) Divide £1000 among A, B, C and D, so that A's share shall be to B's as $\frac{1}{2}$ to $\frac{1}{3}$, B's to C's as $\frac{1}{3}$ to $\frac{1}{4}$, C's to D's as $\frac{1}{4}$ to $\frac{1}{5}$.

(17) Divide £31. 12*s*. 6*d*. among A, B, C and D, so that A's share shall be to B's as 2 to 3, B's to C's as 5 to 6, C's to D's as 8 to 9.

(18) Divide £6045 among A, B, C and D, so that A's share shall e to B's as $\frac{1}{2}$ to $\frac{2}{5}$, B's to C's as $\frac{5}{6}$ to $\frac{4}{9}$, and C's to D's as $\frac{7}{10}$ to $\frac{1}{8}$.

EXERCISE BOOK. PART III.

Exercise I.

Find convergents and limits of error to the values of the following fractions:

(1) $\frac{181}{218}$. (2) $\frac{111}{235}$. (3) $\frac{417}{1002}$.

(4) Reduce the fraction that 1 kilometre (39,370 inches) is of an English mile to a continued fraction, and find 6 convergents.

(5) Find 4 convergents to the ratio of the diameter of a circle to its circumference, 100000 : 314159.

(6) Find 5 convergents to the ratio of a lb. troy to a lb. av.

(7) Find 3 convergents to the ratio of a yard to a metre, 360000 : 393708.

(8) Find 2 convergents to the ratio of a hectare ($11960\frac{1}{3}$ square yds.) to a square mile.

(9) Mont Blanc is 15,784 ft. high, and the diameter of the earth is $7912\frac{2}{5}$ miles. By what *aliquot* fraction of an inch would its height be nearly represented on a globe 18 inches in diameter?

Exercise II.

Reduce to decimal fractions and verify the results:

(1) $\frac{1}{5}$.	(4) $\frac{4}{5}$.	(7) $\frac{5}{8}$.	(10) $\frac{13}{20}$.	(13) $\frac{17}{64}$.
(2) $\frac{2}{5}$.	(5) $\frac{1}{8}$.	(8) $\frac{7}{8}$.	(11) $\frac{2}{25}$.	(14) $\frac{119}{128}$.
(3) $\frac{3}{5}$.	(6) $\frac{3}{8}$.	(9) $\frac{5}{16}$.	(12) $\frac{17}{40}$.	(15) $\frac{39}{125}$.

Exercise III.

I. Give the different readings of:

(1)	·1.	(6)	1·01.	(11)	3·15.
(2)	·01.	(7)	·11.	(12)	31·5.
(3)	·001.	(8)	·31.	(13)	128·053.
(4)	·000001.	(9)	·315.	(14)	12·8053.
(5)	1·1.	(10)	·0315.	(15)	1280·53.

II. Reduce to vulgar fractions at lowest terms:

(1) ·785.	(6) 6·03125.	(11) ·00055.
(2) ·1875.	(7) 603·125.	(12) ·505.
(3) ·73125.	(8) ·55.	(13) 5·05.
(4) ·603125.	(9) ·371.	(14) 8·888.
(5) ·128.	(10) ·00016.	(15) ·728.

EXERCISE IV.

Simplify by vulgar fractions and by decimals, shewing that the results agree:

(1) $7\frac{2}{5} + 4\frac{5}{8} + 9\frac{13}{20} + 11\frac{29}{32}$.
(2) $84\frac{13}{20} + 19\frac{11}{25} + 417\frac{19}{32} + 5043\frac{49}{64} + \frac{41}{50}$.
(3) $4\frac{27}{64} + 13\frac{17}{20} + 42\frac{37}{50} + 418\frac{19}{25} + 2\frac{13}{16} + 1\frac{1}{2}$.
(4) $5\frac{7}{8} + 13\frac{4}{5} + 19\frac{7}{16} + 7\frac{3}{20} + 18\frac{17}{40}$.
(5) $37\frac{5}{16} + 9\frac{4}{5} + \frac{2}{3}$ of $1\frac{4}{5} + \frac{7}{8}$ of $2\frac{2}{7} + \frac{3}{4}$ of $\frac{5}{8}$ of $\frac{7}{10}$.
(6) $9\frac{11}{32} + \frac{47}{100} + 11\frac{19}{128} + 3\frac{3}{5}$ of $4\frac{1}{9} + (\frac{2}{3} - \frac{1}{6})$.

EXERCISE V.

Simplify by vulgar fractions and by decimals:

(1) $7\frac{2}{5} - 4\frac{5}{8}$.
(2) $84\frac{13}{20} - 17\frac{31}{32}$.
(3) $100\frac{2}{25} - 83\frac{17}{20}$.
(4) $100 - 17\frac{113}{625}$.
(5) $82\frac{1}{5} - 37\frac{11}{16}$.
(6) $5\frac{1}{2} - \frac{3}{4}$ of $1\frac{13}{24}$.
(7) $8\frac{1}{5} - 1\frac{1}{2}$ of $\frac{3}{16}$.
(8) $\frac{14}{25} - \frac{11}{64}$.

EXERCISE VI.

By vulgar fractions and by decimals:

(1) $4\frac{7}{25} \times 10, 100, 1000, 10000$.
(2) $56\frac{19}{32} \times 10, 100, 1000, 10000$.
(3) $8\frac{11}{16} \times 10, 100, 1000$.
(4) $\frac{19}{64} \times 10, 100, 1000, 10000000$.

EXERCISE VII.

By vulgar fractions and by decimals:

(1) $43\frac{27}{50} \times 7$; $435\frac{2}{5} \times 7$; $\frac{2177}{5000} \times 7$; $4\frac{177}{500} \times 7$.
(2) $47\frac{5}{8} \times 3, 7, 37, 4, 6, 8, 46, 468$.
(3) $\frac{315}{512} \times 5043, 64$.

By decimals only:

(4) $9000 \times 167{\cdot}432$, ·00719, ·000001.

(5) $\cdot 0678 \times 512000$; $\cdot 03625 \times 102400$.

Exercise VIII.

(1) $16{\cdot}42 \times 4{\cdot}17$.

(2) $1{\cdot}642 \times 41{\cdot}7$.

(3) $\cdot 1642 \times 417$.

(4) $164{\cdot}2 \times \cdot 0417$.

(5) $\cdot 3 \times \cdot 4$; $\cdot 03 \times \cdot 004$; $\cdot 03 \times 1$; $\cdot 03 \times \cdot 1$; $\cdot 003 \times \cdot 001$; $\cdot 005 \times \cdot 04$; $\cdot 004 \times \cdot 05$.

(6) $1{\cdot}1 \times \cdot 011$; $1{\cdot}01 \times \cdot 0101$; $\cdot 04 \times \cdot 04 \times \cdot 05$; $\cdot 1 \times \cdot 1 \times \cdot 01$; $\cdot 7 \times \cdot 4 \times \cdot 3 \times 1000$.

(7) $72{\cdot}159 \times 3{\cdot}27$; $7{\cdot}2159 \times \cdot 327$; $\cdot 72159 \times \cdot 0327$.

(8) $16{\cdot}875 \times 5{\cdot}12$; $1{\cdot}6875 \times 51{\cdot}2$; $\cdot 16875 \times \cdot 0512$.

By vulgar fractions and by decimals:

(9) $4\frac{5}{8} \times 1\frac{1}{2}$; $7\frac{4}{5} \times \frac{3}{16}$; $\frac{13}{64} \times \frac{1}{25}$.

(10) $4\frac{7}{25} \times \frac{1}{5}, \frac{3}{10}, \frac{2}{5}, \frac{1}{2}, \frac{3}{5}, \frac{4}{25}$.

(11) $4\frac{7}{25} \times \cdot 02, \cdot 03, \cdot 04, \cdot 05, \cdot 032, \cdot 302, 3{\cdot}2, \cdot 00032$.

Exercise IX.

By vulgar fractions and by decimals:

(1) $32\frac{5}{16} \div 10, 100, 1000, 10000$.

(2) $4\frac{7}{25} \div 10, 100, 1000$.

(3) $56\frac{19}{32} \div 10, 100$.

Exercise X.

(Verify all these by multiplication.)

(1) $749{\cdot}682 \div 2, 4, 5, 8$.

(2) $32594{\cdot}73 \div 32, 128, 25, 1024$.

(3) $358677{\cdot}9 \div 99288$.

(4) $\cdot 1 \div 64, 512, 50, 800$.

(5) $\cdot 13 \div 52, 10400$.

(6) $\cdot 5 \div 2, 4, 5, 8$.

(7) $\cdot 01 \div 2, 4, 5, 8$.

(8) $\cdot 0073 \div 16, 1600, 160000$.

By vulgar fractions and by decimals:

(9) $28\frac{11}{40} \div 2, 3, 4, 5, 8, 58.$

(10) $13 \div 80$; $429 \div 16000$; $8193 \div 163840000.$

EXERCISE XI.

By vulgar fractions and by decimals:

(1) $\cdot 0073 \div \frac{4}{25}.$

(2) $\cdot 1 \div \frac{1}{5}, \frac{2}{5}, \frac{1}{2}, \frac{4}{5}.$

(3) $93\frac{3}{5} \div \cdot 2, \cdot 3, \cdot 4, \cdot 5, \frac{4}{5}.$

(4) $417\cdot 143 \div 12\frac{4}{5}, \frac{16}{125}, \frac{4}{3125}.$

(5) $\frac{4}{3125} \div 8\frac{24}{125}.$

(6) $1708\cdot 4592 \div \cdot 00024.$

(7) $6\frac{9}{16} \div 1\frac{1}{2}.$

(8) $6\frac{9}{16} \div 4\frac{3}{8}.$

(9) $28\frac{11}{40} \div \cdot 58, \cdot 058, 4\cdot 875, \cdot 4875, 48\cdot 75.$

(10) $\cdot 1 \div \cdot 1$; $\cdot 1 \div 1$; $1 \div \cdot 1$; $\cdot 01 \div \cdot 0004$; $\cdot 0004 \div \cdot 01.$

EXERCISE XII.

(1) Find the value of £·721875.

(2) " ·6 of 1*s.*

(3) " ·045 of 1 cwt.

(4) " ·8 of a year.

(5) " ·2345 of an hour.

(6) " ·0109375 tons.

(7) " ·06412 miles.

EXERCISE XIII.

(1) Reduce 146 days to the decimal of 1 year.

(2) " 77 lbs. " 1 ton.

(3) " 4 dwts., 15 grs. " 1 oz. troy.

(4) " 7 cwt., 3 qrs., $17\frac{1}{2}$ lbs. " 1 cwt.

(5) " 11*s.* $5\frac{1}{4}$*d.* " £1.

(6) " £4. 13*s.* $9\frac{3}{4}$*d.* " £100.

EXERCISE XIV. (*Miscellaneous.*)

(1) Find the sum of 4·173, ·0089, ·2375, ·1, ·01, 246.

(2) What number exceeds ·999 by ·001?

(3) From what vulgar fraction must ·625 be subtracted to leave ·295?

(4) By vulgar fractions and by decimals, find $4\frac{7}{8} + \cdot 01375$.

(5) ·0876 exceeds a certain quantity by ·00876. Find it.

(6) There are two numbers; the greater is 3·142857; their difference is ·001267. Find the less.

(7) If the year is reckoned at $365\frac{1}{4}$ days instead of 365·242264 days, what will be the amount of error in 19 centuries?

(8) Express ·4984 of a day in hours, minutes and seconds.

(9) What fraction contains ·125 ·486 times?

(10) Of what number is ·4 the 25th part?

(11) How many times can ·0085 be subtracted from ·18, and what will be over?

(12) How many times can ·029 be taken out of ·3786, and what will be over?

(13) How much must be subtracted from ·710267875 to leave the largest multiple of ·000000046275 it contains?

(14) Simplify $(7\cdot13 + 3\cdot875) + (7\cdot13 - 3\cdot875) + (7\cdot13 \times 3\cdot875) + (7\cdot13 \div 3\cdot875)$.

(15) Find the reciprocal of ·64.

(16) $72\cdot315 \times 1000$, ·001, $\frac{1}{100}$, $\cdot\frac{1}{001}$.

(17) $72\cdot315 \div 1000$, ·001, $\frac{1}{100}$, $\cdot\frac{1}{001}$.

(18) Find the cost of 12·5 kilolitres at 3·75 francs per litre.

(19) Find the cost per metre if 437·75 metres cost 1805·71875 francs.

(20) Find the value of £·021875 + ·375*s.* + 4·75*d.*

(21) Find the value of £·08 + ·08*s.* + ·09*d.*, and express the result as a decimal of £1.

(22) Add together £1·3625, ·75 of 13*s.* 4*d.*, and $\frac{2}{5}$ of £20.

By vulgar fractions and by decima[illegible] [illegible]nal of £1.

(9) $28\frac{11}{40} \div 2, 3, 4, 5, 8, 58.$ [illegible] vulgar fractions.

(10) $13 \div 80$; $429 \div 16000$; 819[illegible] [illegible]5 + 4·13.

Ex[illegible]

By vulgar fractions an[illegible]

(1) $\cdot 0073 \div \frac{4}{25}$.

(2) $\cdot 1 \div \frac{1}{5}, \frac{2}{5}, \frac{1}{2}, \frac{4}{5}$.

(3) $93\frac{3}{5} \div \cdot 2, \cdot 3, \cdot$[illegible]

(4) $417 \cdot 143 \div 1$[illegible]

(5) $\frac{4}{3125} \div 8$[illegible]

(6) 1708·45

(7) $6\frac{9}{16} +$[illegible] [illegible]025

(8) $6\frac{9}{17}$

(9) 2[illegible] [illegible]es :

(10) [illegible] myriametres, 17·35 decimetres,
17·35 kilometres, 17·35 centimetres,
17·35 hectometres, 17·35 millimetres.

(28) How many square decimetres in a square metre, and how many cubic centimetres in a cubic metre?

(29) Express 500 cubic metres as cubic yards, taking 1 metre = 39·37 inches.

(30) Find G.C.M. and L.C.M. of 64·09 and 7·395.

(31) A sum of money is divided among three persons; the first receives ·375 of the whole, the second ·6, and the third £2·125. Find it.

(32) A does ·375 of a piece of work in 2·25 days, and B does the remainder of it in 3·75 days. How many such pieces of work would A and B together do in 12 days?

(33) Find the value of the following: ·175 tons + ·195 cwt. + ·145 qr. + ·15 lbs. + ·2 oz.

(34) If a gramme is 15·442 grains, and a metre 39·37 inches, how many grammes are there in 1000 grains, and how many metres in a mile?

(35) Simplify $\frac{\cdot 002 \times 1 \cdot 75 \div \cdot 00007}{1\frac{3}{8} \div \frac{1}{8}}$.

(36) Find the sum, difference, product and quotient (the greater being divided by the less) of ·016 and ·02235.

(37) Which is more, and by how much, £·4999 or £·5?

(38) Find the cost of 1 millier at fr. 1·75 per kilog.

(39) Find the cost in English money per lb. av., if 950 grammes* cost fr. 21·23, and fr. $1 = 9\frac{1}{2}d$.

(40) Express in English units: $7\frac{1}{2}$ quintals, 580 kiloms., 85·6 ares, $1437\frac{1}{2}$ francs,† 570 litres.

(41) Reckoning £1 = fr. 25·2215, find the value in French money of £450.

EXERCISE XV.

(1) Construct a similar table with $\frac{7}{11}$ and with $\frac{5}{13}$.

(2) Estimate the difference between:

a. $\frac{5}{17}$ of 1 mile and ·2941 of 1 mile.

b. £$\frac{13}{19}$ and £·6842.

EXERCISE XVI.

(1) Curtail to 5 places ·430718, ·010203, ·430798.

(2) „ to 4 places ·6, ·4, ·27, ·27, 4·09, 4·09.

(3) „ to 7 places ·9, ·09, ·0009, ·379, ·429, ·359.

(4) „ 999·9 to nearest integer.

(5) Reduce $\frac{1}{17}$ to a decimal to 1, 2, 3.....16 places.

EXERCISE XVII.

Simplify the following by vulgar fractions and by decimals:

(1) $\frac{13}{18} + 6\frac{8}{15} + 9\frac{11}{20} + 100\frac{13}{30}$ to 5 places.

(2) $10\frac{4}{11} + 9\frac{5}{13} + 6\frac{2}{3} + 8\frac{112}{143} + 3\frac{5}{9}$ to 5 places.

(3) $8\frac{2}{3} + 9\frac{5}{7} + 3\frac{11}{21} + 6\frac{23}{77} + 4\frac{5}{6} + 10\frac{13}{33} + 2\frac{7}{9}$ to 5 places.

(4) $8\frac{1}{2} + \frac{5}{6} + \frac{11}{14} + 7\frac{3}{10} + 14\frac{17}{21} + \frac{11}{15} + \frac{12}{35}$ to 5 places.

(5) $8\frac{3}{5} + 7\frac{5}{8} + 2\frac{4}{7} + 9\frac{13}{20} + 11\frac{4}{35} + 10\frac{15}{56} + 12\frac{33}{70}$ to 5 places.

(6) $\frac{2}{7}$ of $18 + \frac{3}{5}$ of $1\frac{4}{21}$ to 4 places.

(7) $\frac{13}{18} - \frac{8}{21}$ to 5 places.

(8) $13\frac{2}{75} - 3\frac{8}{15}$ to 5 places.

* 1 gramme = 15·44 grains.

† At $9\frac{1}{2}d$. per fr.

(9) $8\frac{4}{15} - 7\frac{11}{25}$ to 5 places.
(10) $7\frac{4}{7} - \frac{1}{2}$ of $8\frac{3}{11}$ to 5 places.
(11) $\frac{2}{3}$ of $6\frac{1}{2} - \frac{2}{5}$ of 4 to 5 places.
(12) $5\frac{1}{3}$ of $4\frac{1}{2} - 3\frac{1}{4}$ of $3\frac{1}{5}$ to 5 places.
(13) $\frac{1}{5} + \frac{1}{7} + \frac{1}{9} + \frac{1}{11} + \frac{1}{13} + \frac{1}{17}$ to 5 places.

By decimals only:

(14) $\frac{5}{19} + \frac{8}{17} + \frac{4}{23} + \frac{11}{29}$ to 7 places.
(15) $\frac{14}{17} - \frac{7}{12}$ to 7 places.
(16) $(\frac{31}{41} + \frac{14}{43}) - (\frac{31}{41} - \frac{14}{43})$ to 7 places.
(17) $\frac{1}{2} + \frac{1}{3} + \frac{1}{4} + \frac{1}{5} + \frac{1}{6} + \frac{1}{7} + \frac{1}{8} + \frac{1}{9} + \frac{1}{10} + \frac{1}{11} + \frac{1}{12}$ to 4 places.
(18) $(\frac{17}{59} + \frac{14}{61}) + (\frac{17}{59} - \frac{14}{61})$ to 4 places.
(19) $\cdot 4\dot{1}\dot{7} + 4\cdot 3\dot{1}6\dot{2} + 71\cdot\dot{5}\dot{8} + 4\cdot 34\dot{8}\dot{7}$ to 3 places.
(20) $\cdot\dot{8}2461\dot{1} + 43\cdot\dot{7}86\dot{2} - 17\cdot\dot{1}76\dot{4}$ to 5 places.
(21) $\frac{1}{3} + \frac{1}{3\times3} + \frac{1}{3\times3\times3} + \frac{1}{3\times3\times3\times3} + \ldots\ldots$ to 5 places.
(22) $1 + \frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \frac{1}{16} + \frac{1}{32} + \ldots\ldots$ to 6 places.
(23) $1 + 1 + \frac{1}{2} + \frac{1}{2\times3} + \frac{1}{2\times3\times4} + \frac{1}{2\times3\times4\times5} + \ldots\ldots$ to 9 places.
(24) $16 \times (\frac{1}{5} - \frac{1}{3\times5^3} + \frac{1}{5\times5^5} - \frac{1}{7\times5^7} + \frac{1}{9\times5^9} - \frac{1}{11\times5^{11}} + \&c.) - \frac{4}{239}$ to 5 places.

Exercise XVIII.

(1) $\cdot\dot{3} \times 10$, 1000, 100000, to 3 places.
(2) $4\cdot\dot{7}\dot{2} \times 10$, 100, 1000000, to 4 places.

By vulgar fractions and by decimals to 6 places:

(3) $5\frac{8}{9} \times 10$, 100, 10000.
(4) $\frac{7}{12} \times 10$, 100, 10000.
(5) $\frac{13}{14} \times 10000$.
(6) $\frac{5}{17} \times 100$.
(7) $\frac{1}{7200} \times 1000000$.

Exercise XIX.

By vulgar fractions and by decimals:

(1) $\frac{8}{13} \times 7000$ to 4 places.
(2) $\frac{5}{21} \times 300$ „

(3) $\frac{7}{11} \times 80000$ to 4 places.
(4) $\frac{4}{19} \times 19000$ „
(5) $\frac{5}{18} \times 90000$ „
(6) $53\frac{1}{120} \times 50$ „
(7) $\frac{30}{37} \times 2000$ „
(8) $\frac{41}{42} \times 90000$ „
(9) $3\frac{3}{11} \times 6000000$ „

By decimals only :

(10) $3{\cdot}43\dot{1} \times 500$ to 4 places.
(11) $416{\cdot}7\dot{1} \times 4000$ „
(12) ${\cdot}78\dot{4} \times 30000$ „

Exercise XX.

By vulgar fractions and by decimals :

(1) $43\frac{40}{41} \times 259$ to 4 places.
(2) $\frac{16}{29} \times 1043$ „
(3) $1\frac{4}{11} \times 3020$ „
(4) $\frac{14}{15} \times 3015$ to 4 places.
(5) $10\frac{11}{19} \times 9500$ „
(6) $13\frac{143}{2048} \times 8432$ „

Exercise XXI. (*a*).

By vulgar fractions and by decimals, correct to 5 places, find :

(1) $32\frac{5}{7} \times 1\frac{4}{11}$.
(2) $7\frac{2}{3} \times \frac{5}{13}$.
(3) $1\frac{4}{15} \times \frac{7}{8}$.
(4) $1\frac{1}{640} \times \frac{1}{1024}$.
(5) $6528\frac{1}{25000} \times 3794\frac{1}{128}$.
(6) $\frac{11}{19000} \times \frac{4}{365}$.

By decimals only, working each question in two ways, by making each factor multiplier and multiplicand in turn :

(7) ${\cdot}0379\dot{4} \times 5{\cdot}00\dot{8}\dot{4}$ to 5 places.
(8) ${\cdot}111\dot{6} \times 43{\cdot}74\dot{2}85\dot{3}$ to 8 places.
(9) ${\cdot}9321875 \times 4{\cdot}2688$ to 4 places.
(10) ${\cdot}38 \times {\cdot}04125$ to 3 places.
(11) $1{\cdot}48279 \times {\cdot}\dot{3}$ to 5 places.
(12) $468{\cdot}1\dot{2} \times 299{\cdot}875$ to the nearest integer.
(13) The circumference of a circle is 3·14159265...times its diameter. Find in miles to the nearest integer the circumference of the earth, reckoning the equatorial diameter $7925\frac{1}{8}$ miles.

(14) Find in miles to the nearest integer the polar diameter which is $\frac{299}{300}$ of the equatorial diameter.

(15) Find the diameter of the sun, which is 112·06...times the of the earth, correct to within 100 miles.

EXERCISE XXI. (*b*).

Find continued product of:

(1) $49{\cdot}58\dot{3} \times 11{\cdot}4\dot{3}0\dot{2} \times {\cdot}01$ to 4 places.

(2) $\frac{18}{59} \times {\cdot}0\dot{1}0\dot{7} \times \frac{12}{65} \times {\cdot}04$ to 6 places.

(3) $2857{\cdot}5\dot{4} \times 7\frac{53}{91} \times 12\frac{7}{11} \times \frac{1}{6250}$ to 3 places.

(4) $17{\cdot}\dot{8}1\dot{2} \times 5000\frac{14}{15} \times \frac{11}{16} \times {\cdot}001$ to 4 places.

(5) ${\cdot}0\dot{5}9\dot{3} \times {\cdot}0\dot{5}9\dot{3} \times {\cdot}0\dot{5}9\dot{3}$ to 8 places.

(6) ${\cdot}0\dot{8}0\dot{5} \times {\cdot}0\dot{8}0\dot{5} \times {\cdot}0\dot{8}0\dot{5} \times {\cdot}0\dot{8}0\dot{5} \times {\cdot}0\dot{8}0\dot{5} \times {\cdot}0\dot{8}0\dot{5}$ to 9 places

EXERCISE XXII.

(1) $743{\cdot}5\dot{8}\dot{7} \div 10$, 1000, 1000000, to 8 places.

(2) $8{\cdot}3\dot{7} \div 40$ to 5 places.

(3) $74 \div 35000$ to 6 places.

(4) ${\cdot}\dot{5}\dot{3} \div 30$ to 8 places.

(5) ${\cdot}\dot{7}2\dot{5} \div 4{\cdot}31$ to 5 places.

(6) ${\cdot}\dot{1}\dot{8} \div {\cdot}0007$ to 4 places.

(7) $47{\cdot}3\dot{4}\dot{5} \div {\cdot}01$, ${\cdot}001$, ${\cdot}00001$, to 5 places.

(8) ${\cdot}05 \div 630$ to 10 places.

(9) ${\cdot}28473 \div {\cdot}00761$ to 4 places.

(10) ${\cdot}58\dot{1} \div {\cdot}0009$ to 5 places.

(11) ${\cdot}\dot{3}7\dot{0} \div {\cdot}028$ to 6 places.

(12) $2{\cdot}\dot{5} \div 2{\cdot}5$ to 5 places.

(13) ${\cdot}001 \div 44$ to 6 places.

(14) $6{\cdot}587 \div 19$, 1900, to 7 places.

(15) $6{\cdot}\dot{5}8\dot{7} \div {\cdot}19$, $1{\cdot}9$, 19, to 7 places.

(16) $6{\cdot}5\dot{8}\dot{7} \div 4{\cdot}35$, 8100, to 9 places.

(17) $6{\cdot}58\dot{7} \div 4{\cdot}35$, 8100, 4350, ${\cdot}81$, to 10 places.

(18) $.\dot{5}3846\dot{1} \div 1{\cdot}86$ to 3 places.

(19) ${\cdot}\dot{5}3846\dot{1} \div 36$, 360, ${\cdot}0036$, to 6 places.

(20) ${\cdot}\dot{5}3846\dot{1} \div 45$, $4{\cdot}5$, ${\cdot}45$, 45000, to 8 places.

(21) ${\cdot}\dot{0}\dot{7} \div 48007{\cdot}8$ to 5 places.

EXERCISE XXIII. (*a*).

(1) $862 \div 41{\cdot}8\dot{1}7\dot{4}$ to 4 places.
(2) $437 \div 215{\cdot}253$ to 3 places.
(3) $6 \div {\cdot}1573$ to 3 places.
(4) ${\cdot}\dot{7}2\dot{6} \div \dot{0}47\dot{3}$ to 4 places.
(5) ${\cdot}0041\dot{6} \div {\cdot}08\dot{3}$ to 5 places.
(6) $1 \div {\cdot}\dot{1}23\dot{4}$ to 5 places.
(7) $54 \div {\cdot}0003\dot{7}\dot{1}$ to the nearest unit.
(8) ${\cdot}7\dot{2}8\dot{3} \div 4{\cdot}562$ to 5 places.
(9) ${\cdot}\dot{4}6153\dot{8} \div {\cdot}\dot{5}3846\dot{1}$ to 6 places.
(10) ${\cdot}0053 \div 72654$ to 8 places.
(11) ${\cdot}\dot{3} \div {\cdot}\dot{1}4285\dot{7}$ to 6 places.

By vulgar fractions and by decimals, correct to 5 places, find :

(12) $\frac{1}{3} \div \frac{1}{11}$; $\frac{4}{9} \div \frac{3}{7}$; $\frac{4}{9} \div \frac{2}{3}$; $7 \div \frac{1}{7}$; $\frac{1}{11} \div \frac{1}{3}$; $\frac{3}{7} \div \frac{4}{9}$; $\frac{2}{3} \div \frac{4}{9}$; $\frac{1}{7} \div 7$; ${\cdot}042 \div \frac{11}{300}$; $\frac{11}{300} \div {\cdot}042$.

(13) If the length of the year be reckoned at $365\frac{1}{4}$ days, instead of its true length, 365·242264 days, in what time will the error amount to 11 days, also to $2{\cdot}\dot{3}$ days?

EXERCISE XXIII. (*b*).

Simplify :

(1) $\dfrac{{\cdot}8\dot{1}7\dot{2} \times 10{\cdot}\dot{1}2\dot{3} \times {\cdot}178\dot{4}}{{\cdot}019\dot{2}}$ to 4 places.

(2) $\dfrac{{\cdot}007\dot{4}\dot{2} \times {\cdot}6\dot{7}0\dot{3} \times {\cdot}0\dot{6}0\dot{1} \times {\cdot}01}{1{\cdot}\dot{0}5\dot{7}}$ to 7 places.

(3) $\dfrac{7{\cdot}\dot{4}\dot{2} \times 6{\cdot}\dot{7}0\dot{3} \times 60{\cdot}\dot{1}6\dot{0} \times {\cdot}01}{10570570{\cdot}\dot{5}7\dot{0}}$ to 7 places.

(4) $\dfrac{486{\cdot}6875 \times 3{\cdot}875 \times \frac{143}{361}}{100}$ to 4 places.

(5) $\dfrac{9328{\cdot}7125 \times 3{\cdot}48\dot{3} \times \frac{18}{73}}{100}$ to 4 places.

EXERCISE XXIV.

(1) Find the sum of 1, 2, 3, &c., to 1000 terms.
(2) Find the seventieth odd number.

(3) Find the sum of 100 terms of 1, 3, 5, &c.
(4) " 60 " $3\frac{1}{2}$, $4\frac{3}{4}$, 6, &c.
(5) " 75 " ·16, ·18, ·2, &c.
(6) Find the eightieth term of 2·5, 2·75, 3, &c.

(7) If I invest in a Building Society 10*s.* a month for the 1st year, £1 a month for the 2nd year, £1. 10*s.* a month for the 3rd year, and so on, what will be my payment in the 10th year, and how much shall I have invested altogether at the end of the 10th year?

(8) If a stone fall through 16·1 ft. in the 1st second of time, 48·3 ft. in the 2nd second, 80·5 ft. in the 3rd second, and so on, how deep will be the shaft of a mine where a stone takes 7 seconds to reach the bottom?

(9) Prove that in a descending series $l = a - (n-1) \times d$, and, as before, $s = (a + l) \times \frac{n}{2}$.

Exercise XXV.

Sum the series:

(1) 1, 3, 9, &c., to 8 terms.
(2) ·001, ·01, ·1, &c., to 10 terms.
(3) 5, 5^2, 5^3, &c., to 5 terms.
(4) 1, 1·05, 1·05 × 1·05, &c., to 6 terms, correct to 4 places.

Exercise XXVI.

Sum the series:

(1) 1, $\frac{1}{3}$, $\frac{1}{9}$, &c., to 8 terms.
(2) 1, $\frac{1}{5}$, $\frac{1}{5^2}$, &c., to 5 terms.
(3) 1000, 100, 10, &c., to 10 terms.
(4) 3, ·3, ·03, &c., to 10 terms.

Exercise XXVII.

Find the limits of:

(1) $1 + \frac{1}{5} + \frac{1}{5^2} +$ &c.
(2) $3\frac{1}{2} + \frac{1}{2} + \frac{1}{14} +$ &c.
(3) $12 + 3 + \frac{3}{4} +$ &c.
(4) $64 + 8 + 1 +$ &c.
(5) $\cdot 5 + \cdot 25 + \cdot 125 +$ &c.
(6) $20 + 6\frac{2}{3} + 2\frac{2}{9} +$ &c.

EXERCISE XXVIII.

Find the limits of the following :

(1) $\cdot\dot{3}$.	(7) $\cdot\dot{2}\dot{7}$.	(13) $\cdot\dot{1}4285\dot{7}$.	(19) $\cdot\dot{0}13698\dot{6}\dot{3}$.
(2) $\cdot\dot{7}$.	(8) $\cdot\dot{7}\dot{2}$.	(14) $\cdot\dot{8}5714\dot{2}$.	(20) $\cdot\dot{0}7936\dot{5}$.
(3) $\cdot\dot{1}$.	(9) $\cdot\dot{1}3\dot{5}$.	(15) $\cdot\dot{4}2857\dot{1}$.	(21) $\cdot\dot{0}028\dot{7}$.
(4) $\cdot\dot{2}$.	(10) $\cdot\dot{2}3\dot{4}$.	(16) $\cdot\dot{1}5384\dot{6}$.	(22) $\cdot\dot{0}1098\dot{9}$.
(5) $\cdot\dot{6}$.	(11) $\cdot\dot{0}2\dot{4}$.	(17) $\cdot\dot{1}4\dot{4}\dot{1}$.	(23) $\cdot\dot{0}421\dot{2}$.
(6) $\cdot\dot{9}$.	(12) $\cdot\dot{0}7\dot{4}$.	(18) $\cdot\dot{0}243\dot{9}$.	(24) $\cdot\dot{0}0025\dot{9}$.

EXERCISE XXIX.

Find the limits of :

(1) $\cdot 0\dot{3}$.	(3) $\cdot 00\dot{3}\dot{6}$.	(5) $\cdot 00\dot{1}221\dot{3}$.	(7) $\cdot 00\dot{1}0\dot{8}$.
(2) $\cdot 0\dot{7}\dot{2}$.	(4) $\cdot 0\dot{0}3\dot{6}$.	(6) $\cdot 0000\dot{9}$.	(8) $\cdot 000\dot{0}10\dot{8}$.

EXERCISE XXX.

Find the limits of the following :

(1) $\cdot 1\dot{3}\dot{6}$.	(5) $\cdot 04\dot{7}\dot{2}$.	(9) $\cdot 225\dot{9}$.	(13) $\cdot 91\dot{6}$.
(2) $\cdot 6\dot{2}\dot{7}$.	(6) $\cdot 065\dot{6}\dot{3}$.	(10) $\cdot 5\dot{8}\dot{3}$.	(14) $\cdot 0\dot{8}\dot{3}$.
(3) $\cdot 4\dot{7}\dot{2}$.	(7) $\cdot 225\dot{9}$.	(11) $\cdot 41\dot{6}$.	(15) $\cdot 8\dot{3}$.
(4) $\cdot 47\dot{2}$.	(8) $\cdot 2\dot{2}5\dot{9}$.	(12) $\cdot 001\dot{6}$.	(16) $\cdot 5\dot{8}\dot{3}$.

EXERCISE XXXI.

Make a table of every sixpence from 6*d.* to 19*s.* 6*d.*

EXERCISE XXXII.

Make a table of every farthing from $\frac{1}{4}$*d.* to 6*d.*

EXERCISE XXXIII.

Decimalize :

(1) 8*s.* 6*d.*, 17*s.* 6*d.*, 13*s.* 6*d.*, 4*s.* 6*d.*, 1*s.* 6*d.*
(2) 13*s.* 3*d.*, 11*s.* 3*d.*, 19*s.* 3*d.*, 15*s.* 9*d.*, 18*s.* 9*d.*, 1*s.* 9*d.*
(3) 14*s.* $5\frac{1}{4}$*d.*, 11*s.* $10\frac{1}{2}$*d.*, 18*s.* $7\frac{1}{2}$*d.*, 3*s.* $11\frac{1}{4}$*d.*

(4) 8*d.*, 10*d.*, 7*d.*, $3\frac{1}{2}$*d.*, 1*s.* 1*d.*, 7*s.* 4*d.*

(5) 13*s.* 5*d.*, 17*s.* $10\frac{1}{4}$*d.*, 15*s.* $9\frac{1}{2}$*d.*, 13*s.* $8\frac{1}{2}$*d.*, 1*s.* $11\frac{1}{2}$*d.*, $\frac{1}{4}$*d.*, 1*d.*, 17*s.* $0\frac{1}{4}$*d.*, 11*s.* $0\frac{1}{2}$*d.*, 12*s.* $0\frac{1}{4}$*d.*

Exercise XXXIV.

Read off the cost of 10, 100, 1000, 10000, 100000, 10000 articles at :

(1) 8*s.* 6*d.*
(2) 9*s.* $5\frac{1}{4}$*d.*
(3) £2. 17*s.* $4\frac{1}{2}$*d.*
(4) £3. 1*s.* $8\frac{1}{4}$*d.*
(5) 16*s.* $3\frac{3}{4}$*d.*
(6) £4. 13*s.* $3\frac{3}{4}$*d.*
(7) 2*s.* $7\frac{1}{4}$*d.*
(8) 3*s.* 7*d.*
(9) 4*s.* $8\frac{3}{4}$*d.*
(10) 5*s.* $10\frac{3}{4}$*d.*
(11) 6*s.* 4*d.*
(12) 1*s.* $5\frac{1}{2}$*d.*
(13) 4*s.* 2*d.*
(14) 6*s.* 1*d.*
(15) 8*s.* $0\frac{1}{4}$*d.*
(16) 12. $0\frac{1}{2}$*d.*

Exercise XXXV.

I.

(1) 3562 articles at 15*s.* $8\frac{3}{4}$*d.* each.
(2) 6019 „ £1. 2*s.* 10*d.* each.
(3) 7038 „ £3. 14*s.* $2\frac{3}{4}$*d.* each.
(4) 269 „ 3*s.* $10\frac{3}{4}$*d.* each.
(5) 5966 „ £7. 16*s.* 8*d.* each.
(6) 2469 „ £1. 10*s.* $10\frac{1}{4}$*d.* each.
(7) 9004 „ £2. 7*s.* $6\frac{1}{2}$*d.* each.
(8) 5040 „ 7*s.* $11\frac{1}{2}$*d.* each.
(9) 10010 „ 1*s.* $8\frac{3}{4}$*d.* each.
(10) 5039 „ 3*s.* $7\frac{1}{2}$*d.* each.

II.

(1) $843\frac{4}{5}$ articles at £3. 16*s.* $8\frac{3}{4}$*d.* each.
(2) $2047\frac{2}{3}$ „ £1. 17*s.* $2\frac{1}{2}$*d.* each.
(3) $3195\frac{5}{6}$ „ £2. 2*s.* $2\frac{1}{2}$*d.* each.
(4) 9843 doz. and 5 articles at 3*s.* $2\frac{1}{4}$*d.* per dozen.
(5) 7054 doz. and 11 „ £1. 9*s.* 10*d.* per dozen.
(6) 2437 doz. and 7 „ £2. 13*s.* $9\frac{1}{2}$*d.* per dozen.

(7) 5 years and 7 months at £31. 11*s.* 6*d.* a year.
(8) 10 years and 5 months at £9. 17*s.* 3*d.* a year.
(9) 17 years and 11 months at £10. 10*s.* 10*d.* a year.
(10) £1870. 16*s.* 8*d.* at 7*s.* $9\frac{3}{4}$*d.* in the £.
(11) £497. 10*s.* 4*d.* at 16*s.* $7\frac{1}{4}$*d.* in the £.

III.

(1) $2473\frac{13}{25}$ articles at £6. 5*s.* 8*d.* each.
(2) $649\frac{5}{7}$ „ £1. 16*s.* 2*d.* each.
(3) $4037\frac{3}{11}$ „ £2. 11*s.* $8\frac{1}{2}$*d.* each.
(4) $953\frac{13}{15}$ „ £8. 7*s.* 10*d.* each.
(5) $2583\frac{7}{16}$ „ £3. 3*s.* $11\frac{1}{2}$*d.* each.
(6) $7211\frac{7}{10}$ „ £1. 18*s.* $7\frac{3}{4}$*d.* each.
(7) $2045\frac{4}{17}$ „ £2. 2*s.* $9\frac{1}{2}$*d.* each.
(8) $477\frac{43}{73}$ „ £4. 9*s.* 8*d.* each.
(9) 700700·07 „ £10. 5*s.* 7*d.* each.
(10) $843594\frac{3}{4}$ „ $6\frac{1}{2}$*d.* each.

Exercise XXXVI.

(1) 28493 lbs. of raw cotton at $9\frac{11}{16}$*d.*
(2) 97058 „ 1*s.* $0\frac{5}{8}$*d.*
(3) 247963 „ $11\frac{19}{32}$*d.*
(4) 519766 lbs. of waste cotton at $1\frac{25}{64}$*d.*
(5) 27964 „ $3\frac{1}{5}$*d.*
(6) 24572 „ $4\frac{4}{7}$*d.*
(7) 24572 „ $2\frac{2}{5}$*d.*
(8) 967458 „ $\frac{53}{64}$*d.*
(9) 1000000 „ $1\frac{3}{7}$*d.*
(10) 257683 „ $2\frac{7}{10}$*d.*
(11) 489573 „ $4\frac{13}{20}$*d.*
(12) 359087 „ 1*s.* $1\frac{11}{20}$*d.*

Exercise XXXVII.

Work by decimals Exercise XX. in Part. I.

EXERCISE XXXVIII.

Find the cost of:

(1) 43 tons, 17 cwt., at £5. 8*s*. 3*d*. per ton.
(2) 457 tons, 9 cwt., at £7. 10*s*. 10*d*. per ton.
(3) 8 tons, 1 cwt., at £1. 9*s*. 4½*d*. per ton.
(4) 9 tons, 8 cwt., 1 qr., at 16*s*. 8¾*d*. per ton.
(5) 6 tons, 13 cwt., 2 qrs., at 17*s*. 9*d*. per ton.
(6) 7 tons, 5 cwt., 3 qrs., at 12*s*. 5*d*. per ton.
(7) 4 tons, 4 cwt., 1 qr., 7 lbs., at £43. 12*s*. 6*d*. per ton.
(8) 12 tons, 2 cwt., 2 qrs., 14 lbs., at £52. 10*s*. per ton.
(9) 23 tons, 3 cwt., 3 qrs., 21 lbs., at £24. 10*s*. 10*d*. per ton.
(10) 16 cwt., 1 qr., 14 lbs., at £18. 17*s*. 4*d*. per ton.

EXERCISE XXXIX.

Find the cost of:

(1) 18 tons, 9 cwt., 1 qr., 16 lbs., at £3. 10*s*. 4*d*. per ton.
(2) 23 tons, 0 cwt., 2 qrs., 20 lbs., at £5. 4*s*. 7½*d*. per ton.
(3) 93 tons, 7 cwt., 3 qrs., 8 lbs., at £6. 15*s*. 8*d*. per ton.
(4) 7 tons, 5 cwt., 1 qr., 21 lbs., at £10. 4*s*. per ton.
(5) 86 tons, 11 cwt., 2 qrs., 11 lbs., at £51. 17*s*. 4½*d*. per ton.
(6) 17 cwt., 3 qrs., 26 lbs., at £9. 12*s*. 10*d*. per ton.
(7) 3 tons, 3 cwt., 3 qrs., 3 lbs., at £3. 3*s*. 3*d*. per ton.
(8) 2 tons, 14 cwt., 1 qr., 7 lbs., at £2. 14*s*. 3¾*d*. per ton.
(9) 5 cwt., 9 lbs., at £16. 16*s*. per ton.
(10) 4 tons, 1 qr., at £2. 5*s*. 8*d*. per ton.

EXERCISE XL.

Find the cost of:

(1) 4 cwt., 1 qr., 17 lbs., at £3. 3*s*. per cwt.
(2) 3 qrs., 19 lbs., at £7. 8*s*. 4*d*. per cwt.
(3) 1 ton, 7 cwt., 3 qrs., 24 lbs., at £10. 12*s*. 8*d*. per cwt.
(4) 3 cwt., 2 qrs., 16 lbs., at £3. 7*s*. 8*d*. per cwt.
(5) 9 tons, 5 cwt., 16 lbs., at 12*s*. per cwt.

(6) 45 tons, 1 qr., 9 lbs., at £2. 7*s*. 10*d*. per cwt.
(7) 3 tons, 2 qrs., 8 lbs., at £5. 7*s*. 4*d*. per cwt.
(8) 3 cwt., 3 qrs., 12 lbs., at £1. 4*s*. 11*d*. per cwt.
(9) 15 tons, 15 cwt., 1 qr., 20 lbs., at £10. 10*s*. per cwt.

EXERCISE XLI.

Find the cost of:

(1) 3 qrs., 17 lbs., 5 oz., at 3*s*. 8*d*. per lb.
(2) 4 lbs., 14 oz., at £1. 17*s*. 6*d*. per lb.
(3) 9 oz., at £2. 15*s*. 4*d*. per lb.
(4) 15 lbs., 15 oz., at £6. 4*s*. 10½*d*. per lb.
(5) 1 cwt., 10 lbs., 6 oz., at 18*s*. 7½*d*. per lb.
(6) 9 lbs., 8 oz., at £2. 14*s*. 11*d*. per lb.

EXERCISE XLII.

(1) Find the cost of 17 lbs., 9 oz., 15 dwts., at £8. 4*s*. 11*d*. per lb.
(2) " 9 lbs., 6 oz., 19 dwts., at £4. 19*s*. 4½*d*. per lb.
(3) " 1 lb., 7 oz., 15 dwts., 20 grs., at £3. 17*s*. 10½*d*. per oz.
(4) " 8 oz., 11 dwts., 17 grs., at £1. 14*s*. 10*d*. per oz.
(5) " 10 oz., 10 dwts., 10½ grs., at £7. 11*s*. 4*d*. per oz.
(6) " 4 lbs., 11 oz., 11 dwts., 11½ grs., at £10. 10*s*. per oz.

EXERCISE XLIII.

(1) Find the cost of 15 gals., 3 qts., 1 pt., 3 gills, at 10½*d*. per gal.
(2) " 2 qts., 1 pt., 1 gill, at 1*s*. 4¾*d*. per gal.
(3) " 29 gals., 1 qt., 1 pt., 2 gills, at 2*s*. 10½*d*. per gal.
(4) " 428 qrs., 3 bus., 2 pecks, at £2. 13*s*. 6*d*. per qr.
(5) " 617 qrs., 1 bus., 3 pecks, at £1. 3*s*. 9*d*. per qr.

EXERCISE XLIV.

(1) Find the value of 7 chains, $3\frac{3}{4}$ links, at 8*s.* $10\frac{1}{2}$*d.* per chain.
(2) " 49 chains, $18\frac{1}{2}$ links, at 16*s.* $5\frac{1}{4}$*d.* per chain.
(3) " 356 chains, $59\frac{1}{4}$ links, at £2. 14*s.* 8*d.* per chain.
(4) " 315 miles, 6 fur., at £768. 15*s.* per mile.
(5) " 19 yds., 2 ft., 8 in., at 7*s.* $8\frac{1}{2}$*d.* per yd.
(6) " 43 yds., 1 ft., 11 in., at 2*s.* $5\frac{3}{4}$*d.* per yd.
(7) " 1 mile, 4 fur., 77 yds., at £100 per mile.
(8) " 5 miles, 5 fur., 50 yds., at £20. 8*s.* per mile.

EXERCISE XLV.

(1) Find the cost of a close of 37 acres, 3 roods, 25 poles, at £42. 10*s.* per acre.
(2) " field of 19 acres, 1 rood, 35 poles, at £57. 15*s.* per acre.
(3) " farm of 368 acres, 2 roods, 30 poles, at £41. 15*s.* per acre.

(4) I bought 1572 acres, $1\frac{1}{2}$ roods, at £37. 17*s.* 6*d.* per acre, and of it sold of the best land 419 acres, $3\frac{1}{2}$ roods, at £47. 5*s.* an acre; how much an acre did the remainder stand me in?

EXERCISE XLVI.

Work, Part II., Ex. LI., Nos. 4, 7, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 28, 29, 53, 54.

EXERCISE XLVII.

(1) Find the insurance on £560 at $2\frac{3}{4}$ %.
(2) Find the insurance on £712. 10*s.* 8*d.* at $3\frac{5}{8}$ %.
(3) Find $5\frac{3}{8}$ % on £77. 7*s.* 7*d.*
(4) Find the brokerage on 750 guineas at $1\frac{1}{4}$ %.
(5) Find the brokerage on 4593 doz. at 5*s.* $10\frac{1}{2}$*d.* per doz. at $\frac{7}{8}$ %.
(6) Find the commission on £2595 at $2\frac{1}{2}$ %.
(7) Find the premium of fire insurance on £1550 at 3*s.* 4*d.* %.

(8) Find the profit realized on £1470 at $12\frac{1}{2}$ %.

(9) Find the loss on goods bought for £370 and sold at a loss of $7\frac{3}{8}$ %.

(10) Goods bought for £275. 13*s*. 10*d*. are sold at a profit of $15\frac{7}{8}$ %. What were they sold for?

(11) 17,500 dozen handkerchiefs were bought at 4*s*. $4\frac{1}{2}$*d*. per dozen, and sold at a profit of $17\frac{3}{4}$ %. How much were they sold for?

(12) A population of 357,600 increased $3\frac{1}{2}$ % in a certain year; the deaths were 11,920. Find the number of births.

EXERCISE XLVIII.

I.

(1) Find the interest on £350 for 2 years at 5 %.
(2) " " £350 " 5 " 2 %.
(3) " " £765 " $1\frac{1}{2}$ " $2\frac{3}{4}$ %.
(4) " " £548. 16*s*. 3*d*. for 9 months at $4\frac{7}{8}$ %.
(5) " " £3456. 17*s*. 6*d*. for $4\frac{1}{2}$ " $3\frac{3}{4}$ %.
(6) " " £279. 12*s*. 10*d*. for 6 " $4\frac{3}{8}$ %.

II.

(1) Find the interest on £37. 18*s*. 9*d*. at $2\frac{7}{8}$ % for 47 days.
(2) " " £143. 10*s*. 8*d*. at $4\frac{5}{8}$ % for 100 days.
(3) " " £75. 16*s*. at $6\frac{1}{8}$ % for 42 days.
(4) " " 1000 guineas at 5 % for 12 days.
(5) " " £10490 at $4\frac{3}{4}$ % for 80 days.
(6) " " £876. 13*s*. 4*d*. at $3\frac{5}{8}$ % for 146 days.

III.

(1) Find the interest on £1745. 12*s*. 8*d*. at £12. 15*s*. 8*d*. % for 130 days.
(2) " " £2495. 17*s*. 4*d*. at £13. 16*s*. 10*d*. % for 67 days.
(3) " " £65. 4*s*. 10*d*. at £5. 1*s*. $7\frac{1}{4}$*d*. % for 91 days.
(4) " " £147. 16*s*. 6*d*. at £7. 12*s*. $10\frac{1}{2}$*d*. % for 39 days.

(5) Find the interest on £439. 10*s.* 3*d.* at £9. 8*s.* 5*d.* % f
117 days.

(6) " " £455. 5*s.* 5*d.* at £8. 15*s.* 5¾*d.* % f
19 days.

IV.

Find the amount on :

(1) £1483. 17*s.* 4*d.* for 1 year, 5 months, at 6¼ %.
(2) £1517. 16*s.* 2⅖*d.* for 4 years, 8 months, at 5 %.
(3) £2045. 3*s.* 10*d.* for 76 days at 3⅝ %.
(4) £439. 11*s.* 5*d.* for 91 days at 4⅔ %.
(5) £254. 8*s.* 7*d.* for 145 days at £5. 8*s.* 11¼*d.* %.
(6) £7777. 7*s.* 7*d.* for 77 days at £7. 7*s.* 7*d.* %.

V.

Find the interest for 1 minute on the national debt, £730,000,0(at 3 % per annum.

Exercise XLIX.

*(1) If goods are bought for £415 and sold for £500, what the gain % ?

(2) If the goods had been sold for £400, what would have be the loss % ?

(3) On the breaking out of the war of 1870, the marine ins rance of certain goods was raised from 2 to 5½ %, making a diff ence of £140 in the premium to be paid. Find the value of t goods.

(4) A bought a horse for £40, and sold it to B at a profit 8¾ %; B sold it at a loss of 7½ % to C. What did C pay for t horse?

(5) What would C have paid if B had made 7½ % profit?

(6) I bought French jewellery for fr. 7490, and paid an impo duty of 15 % ad valorem; I sold it for £420. Find my gain or lo %, reckoning the £ at fr. 25·22.

(7) If 3¾ tons of sulphur are required to make 31 tons, 5 cwt. gunpowder, what is the percentage of sulphur in gunpowder?

* When not otherwise stated, find to 3 places.

(8) At what rate will the brokerage on £1720. 16*s.* 8*d.* amount to £6. 9*s.* $0\frac{3}{4}$*d.*?

(9) On what sum will the brokerage at $\frac{5}{8}$ % amount to £10. 15*s.*?

(10) In a school of 80 children $17\frac{1}{2}$ % are girls. Find the number of boys.

(11) Find the rates to be paid on a house rented at 60 guineas and rated at 85 % of the rent, paying 1*s.* $3\frac{1}{2}$*d.* in the £.

(12) The total number of prisoners in a certain county was 493, of whom $\frac{17}{29}$ were males. The number of male prisoners in the following year was 272, and that of females $108\frac{1}{3}$ % of the former number. Find the total increase or decrease %.

(13) This year the number of out-door and in-door patients of a hospital were 1575 and 333 respectively; in the previous year the former were ·96 of this year's number, and the total was 1870. Find to one place the increase or decrease % of the in-door patients.

(14) A certain grocer's weekly business is as follows:

Goods.	Cost price.	Selling price.
5 cwt. of raw sugar	@ 36*s.* per cwt.	@ 4*d.* per lb.
$2\frac{1}{2}$,, loaf sugar	,, 44*s.* ,,	,, $5\frac{1}{2}$*d.* ,,
$\frac{1}{2}$,, coffee	,, 84*s.* ,,	,, 1*s.* 6*d.* ,,
which loses 20 % in roasting, and costs further 3*d.* per lb. duty and 2*s.* 6*d.* per cwt. roasting.		
40 lbs. of tea	,, 2*s.* 8*d.* per lb.	,, 3*s.* 4*d.* ,,
$\frac{1}{2}$ cwt. of rice	,, 26*s.* per cwt.	,, 4*d.* ,,
10 lbs. of cocoa	,, 1*s.* 1*d.* per lb.	,, 1*s.* 4*d.* ,,
15 ,, ,,	,, $6\frac{3}{4}$*d.* ,,	,, 8*d.* ,,
Sundries	£19. 12*s.*	£25. 8*s.* 6*d.*

Find (*a*) the weekly profit realized; (*b*) the gain or loss % on each article; (*c*) the total gain %.

(15) If an investment of £91. 17*s.* 6*d.* yield me £3. 10*s.* per annum, what percentage do I get?

EXERCISE L.

(1) In what time will the interest on £455. 10*s.* amount to £1. 17*s.* $11\frac{1}{2}$*d.* at 5 %?

(2) In what time will the interest on £368. 15*s.* 4*d.* amount to £15 at £6. 13*s.* 10*d.* %?

(3) In what time will a principal of £360 amount to 400 guineas at 5 %?

(4) At what rate will the interest on £15 in $4\frac{1}{2}$ months amount to 7*s.* $10\frac{1}{2}$*d.*?

(5) What principal will, at £4. 18*s.* 9*d.* %, yield 500 guineas a year?

(6) In 2 years, 53 days, a principal of £1000 amounted to £1200. Find the rate charged.

(7) What sum will, at $8\frac{3}{4}$%, yield 19 guineas interest in 3 months?

(8) Find x in each of the following:

	Principal.	Rate %.	Time.	Interest.
a.	£465,	$3\frac{1}{2}$,	47 days,	x.
b.	£x,	£4. 17*s.*,	1 yr., 4 mos.,	£70. 14*s.* 7*d.*
c.	£24,000	x,	1 year,	£900.
d.	£230. 17*s.* 3*d.*,	$2\frac{1}{2}$,	x,	£3. 2*s.* 8*d.*

EXERCISE LI.

(1) Find the present value of:

a. £427. 10*s.* 6*d.*, discounted at $3\frac{1}{2}$ %, due in 3 months.
b. £6359. 18*s.* 4*d.* " $4\frac{3}{4}$ %, " 4 "
c. £794. 11*s.* " 5 %, " 6 "
d. £82. 13*s.* 4*d.* " $5\frac{3}{8}$ %, " 70 days.
e. £445. 10*s.* " $3\frac{7}{8}$ %, " 94 "
f. £1250 " £2. 17*s.* 8*d.* %, due in 114 days.

(2) Find the discount on a bill of:

a. £700, due March 5—8, discounted January 4, at 5 %.

b. £376, due August 20—23, discounted May 11, at $4\frac{1}{2}$ %.

c. £40. 10*s.* 6*d.*, due September 30—October 3, discounted September 17, at $3\frac{1}{4}$ %.

d. £461. 3*s.* 6*d.*, due October 9—12, discounted May 5, at $7\frac{1}{2}$ %.

(3) Find the present value of a bill of:

a. £629. 12*s.*, drawn May 11, at 3 months, discounted June 2, at $5\frac{3}{8}$ %.

b. £485. 19*s.* 3*d.*, drawn July 31,* at 4 months, discounted November 11, at $8\frac{1}{2}$ %.

c. £374. 16*s.*, drawn March 10, at 90 days, discounted April 1, at $6\frac{7}{8}$ %.

(4) Find the difference between simple interest and discount on:

a. £760 at $3\frac{5}{8}$ % for 68 days.

b. £1848. 10*s.* 10*d.* at $4\frac{2}{5}$ % for 80 days.

c. £2466. 13*s.* 4*d.* at $5\frac{3}{5}$ % for 99 days.

EXERCISE LII.

(1) If by selling an article at £1. 1*s.* 9*d.* a pound I gain 16 %, what was the prime cost?

(2) I bought 100 gallons of brandy at 17*s.* 6*d.* per gallon; $9\frac{1}{2}$ gallons are lost by leakage; the remainder is put into bottles holding $1\frac{1}{3}$ pints; at what price per bottle must it be sold so as to gain $18\frac{1}{2}$ %?

(3) For how much should goods worth £635 be insured at $2\frac{1}{2}$ % to recover the value of goods and premium?

(4) Also goods worth £100 at 5%?

(5) " £67. 10*s.* at 4 %?

(6) Goods bought at £2. 5*s.* 10*d.* per cwt. are sold at £2. 14*s.* 1*d.*; what is the gain per cent.?

(7) Of goods worth £1000, one-third is sold at a profit of 15 %; for how much must the remainder be sold to gain 20 % on the whole?

(8) I bought sugar at £1. 18*s.* 6*d.* per cwt.; at how much per lb. must I sell it to lose 4 %? (To be worked accurately.)

(9) If by selling wine at 15*s.* a gallon I lose 10 %, at what price must I sell it to gain 15 %?

(10) A person buys coffee at £5. 12*s.* 6*d.* per cwt., and chicory at £2. 5*s.* 5*d.*, and mixes them in the proportion of 2 of chicory to 5 of coffee. He retails the mixture at 1*s.* 3*d.* per lb.; what is his gain or loss %?

* This will be due November 30—December 3.

(11) I bought 4 cwt. of sugar at 4*d.* per lb., and 7 cwt. at 5*d.* per lb.; at how much per lb. must I sell the mixture to gain 20 %?

(12) A bought 150 eggs at 2 a penny, and 150 at 3 a penny; he sold them all at 5 for 2*d.* How much % did he gain or lose?

(13) I bought 580 metres of silk at 6·65 fr. per metre, and sold 300 yards at 6*s.* 9½*d.* per yard, and the remainder at 7*s.* per yard; find the gain or loss %, reckoning 1 metre = 39·37 in., and £1 = 25·22 fr.

(14) If apples are bought at 4 for 1½*d.*, how many should be sold for 3½*d.* to gain 75 %?

(15) I bought a Geneva watch and paid duty at the rate of 10 %. I sold the watch for £21, making a profit of 15 % on my whole outlay. Find the original cost in francs at 9½*d.* each.

Exercise LIII.

(1) Find the compound interest on:

a. £585 for 2 years, reckoned quarterly, at 4 % per annum.
b. £1000 for 10 years at 5 %, reckoned yearly.
c. £60 at 5 % for 1 year, reckoned monthly.
d. £145. 17*s.* 6*d.* for 2½ years at 3½ %, reckoned half-yearly.
e. £624. 12*s.* 8*d.* for 5 years at 3⅞ %, reckoned yearly.
f. £815. 13*s.* 9*d.* at £2. 17*s.* 9*d.* % for 3 years, reckoned half-yearly.

(2) Find the difference between simple and compound interest reckoned half-yearly, on £850 for 3 years at 5½ % per annum.

(3) Find the difference between simple and compound interest reckoned yearly, on £738. 15*s.* at 4¾ % per annum, for 4 years.

(4) Find the compound interest reckoned (*a*) yearly, (*b*) half-yearly, and (*c*) quarterly, on £1000 for 3 years at 4 % per annum.

Exercise LIV.

What sum of money will amount to:

a. £500 at 5 % per annum compound interest, reckoned yearly, in 4 years?
b. £750 at 4 %, reckoned six-monthly, in 2½ years?
c. *1000 guineas* at 3½ %, in 5 years, reckoned yearly?

Exercise LV.

(1) How much stock can be bought for £8450 at $93\frac{1}{4}$?
(2) " " £748. 16*s.* at $89\frac{7}{8}$?
(3) What will be realized by selling out £350 Consols at $91\frac{1}{2}$?
(4) " " £68. 4*s.* 6*d.* Consols at $87\frac{3}{4}$?

Exercise LVI.

Find the sum to be paid for:

(1) £8350 Three per cent. Consols, at $94\frac{1}{2}$, brokerage $\frac{1}{8}$.
(2) £746. 18*s.* 6*d.* Three per cent. Consols, at $91\frac{7}{8}$, brokerage $\frac{1}{8}$
(3) £844. 4*s.* 4*d.* Three per cent. Consols, at $89\frac{1}{4}$, brokerage $\frac{1}{8}$.
(4) £768. 17*s.* 11*d.* Three per cent. Consols, at 88, brokerage $\frac{1}{8}$.

What will be realized by selling out:

(5) £600 Three per cent. Consols, at 90, brokerage $\frac{1}{8}$.
(6) £937. 12*s.* 11*d.* Three per cent. Consols, at $90\frac{1}{2}$, brokerage $\frac{1}{8}$.
(7) £666. 13*s.* 4*d.* Three per cent. Consols, at $86\frac{5}{8}$, brokerage $\frac{1}{8}$.
(8) £27468. 10*s.* Three per cent. Consols, at $91\frac{1}{4}$, brokerage $\frac{1}{8}$.

Exercise LVII.

(1) If the English 3 per cent. funded debt amounts to £723,120,000, find the diminution of its value in the market caused by the outbreak of the German-French war in 1870. Quoted $92\frac{5}{8}$ on June 22, and $88\frac{3}{8}$ August 5th.

(2) Find the profit or loss on each of the following operations (brokerage $\frac{1}{8}$ % on each transaction):

	Stock.	Bought in at	Sold out at
a.	£80,000,	$91\frac{5}{8}$,	90.
b.	£17,500,	$88\frac{7}{8}$,	$89\frac{1}{8}$.
c.	£51,600,	$86\frac{1}{4}$,	$89\frac{1}{2}$.
d.	fr. 30,000,	65·75,	67·35.

EXERCISE LVIII.

(1) What yearly income will be derived from £895 invested in the 5 per cents. at 105?

(2) What yearly income is derived from the investment of £10,000 in the 3 per cent. Consols at $91\frac{1}{2}$?

(3) Find the yearly income derived from investing £750 in the 5 per cent. Austrian Metalliques at $48\frac{7}{8}$.

(4) How much must I invest in the 4 per cents. at $93\frac{5}{8}$ to realize a yearly income of £120?

(5) How much must be invested in the $3\frac{1}{2}$ per cents. at $87\frac{3}{4}$ to realize a six-monthly dividend of £75?

(6) Work the above five sums, allowing $\frac{1}{8}$ % brokerage.

(7) Find the yearly rate of interest obtained from the following investments:

a. Consols 3 per cent. at $88\frac{3}{8}$.
b. French Rentes 3 per cent. at 66·90.
c. Prussian 5 per cent. at 88.
d. Russian $4\frac{1}{2}$ per cent. at 86.
e. Turkish 6 per cent. (1854) at $81\frac{1}{2}$.
f. Turkish 5 per cent. (1865) at $38\frac{1}{2}$.

EXERCISE LIX.

(1) Which of the following pairs is the more profitable investment:

a.	4 per cents. at 95,	and	$3\frac{1}{2}$ per cents. at 84.		
b.	$3\frac{1}{2}$	„	$67\frac{1}{4}$, and 4	„	$81\frac{1}{2}$.
c.	$5\frac{3}{4}$	„	$110\frac{1}{2}$, and 3	„	$67\frac{5}{8}$.

(2) Find the differences in income, supposing £584. 10*s.* were invested in each of the pairs in (1).

(3) Find the difference in income between investing £1500 in the 3 per cent. Consols at $88\frac{7}{8}$, and in $12\frac{1}{2}$ per cent. Bank stock at $185\frac{1}{2}$, brokerage $\frac{1}{8}$.

EXERCISE LX.

(1) Find the price of $4\frac{1}{2}$ % to equal the $3\frac{1}{2}$ % at $88\frac{1}{2}$.
(2) " $3\frac{3}{4}$ " 4 " $92\frac{1}{4}$.
(3) " 4 " 5 " $100\frac{7}{8}$.
(4) " $2\frac{1}{2}$ " $3\frac{1}{2}$ " $68\frac{5}{8}$.
(5) What should the 5 % be when the 3 % are at $89\frac{1}{2}$?
(6) " $3\frac{1}{2}$ " $5\frac{3}{4}$ " par?

EXERCISE LXI.

Find the alteration in the amount of stock held, the income derived and the rate %, if the following transfers are effected:

	Amount transferred	from	at	to	at
(1)	£7850,	$3\frac{1}{2}$ %,	66·90,	5 %,	90.
(2)	£5465,	$4\frac{3}{4}$ "	$90\frac{1}{2}$,	$2\frac{1}{2}$ "	$47\frac{1}{2}$.
(3)	£690,	3 "	$76\frac{1}{2}$,	4 "	$82\frac{5}{8}$.
(4)	£3567. 14*s*. 10*d*.,	3 "	88,	$3\frac{1}{2}$ "	par.
(5)	£1487. 11*s*. 8*d*.,	$3\frac{1}{4}$ "	90,	$6\frac{1}{2}$ "	180.
(6)	10,000 guineas,	3 % Consols,	$88\frac{3}{8}$,	5 % Italians	at $46\frac{1}{2}$.

EXERCISE LXII.

(1) Find the six-monthly dividend derived from investing 1000 guineas in £50 railway shares at par, yielding $3\frac{1}{2}$ per cent. per annum.

(2) Find the price per cent. of mining shares issued at £15 and sold at $2\frac{1}{2}$ discount.

(3) Find the rate of interest on shares, £35 paid up, yielding a half-yearly dividend of £2. 14*s*.

(4) Find the rates of interest obtained by investing in the following railway shares:

a. London and North Western, quoted at $124\frac{1}{2}$, paying 6 % per an.
b. Midland, " 124, " $6\frac{1}{4}$ % "
c. Great Western, " $67\frac{3}{4}$, " $3\frac{9}{40}$ % "
d. South Eastern, " 67, " $2\frac{1}{2}$ % "

(5) Find the yearly income derived from the investment of every £100 in the Austrian 5 per cents. at 48·55, deducting 16 % income tax.

(6) I invested £1450 in the 3 per cents. at $88\frac{1}{2}$, and sold out when they had risen $2\frac{1}{4}$ %. What was my gain?

(7) How much stock must I sell out of the $3\frac{1}{2}$ per cents. at $81\frac{7}{8}$ to enable me to buy £5000 4 per cent. stock at $94\frac{1}{2}$, brokerage $\frac{1}{8}$ in each transaction?

(8) What is the price of stock if £8000 stock can be bought for £5830?

(9) My half-yearly dividend from the 3 per cents. is £247. 10*s.* How much stock do I hold, and what shall I realize by selling out at $89\frac{1}{2}$, brokerage $\frac{1}{8}$?

(10) How much stock must I sell out from the 4 per cents. at $96\frac{7}{8}$ to raise a sufficient sum for discounting a bill for £1000, due 52 days hence and discounted at $5\frac{1}{2}$ %?

(11) Find the yearly income derived from investing a legacy of £4583. 10*s.* in the 3 per cent. Consols at $91\frac{7}{8}$, allowing for legacy duty 5 %, brokerage $\frac{1}{8}$ %, deducting an income tax of 5*d.* in the £.

(12) I invested £1460 in the $4\frac{1}{2}$ per cents. at $100\frac{1}{4}$, and sold when they had fallen, losing £100, inclusive of the double brokerage. Find the selling price.

(13) What would this selling price have been if I had cleared £100?

(14) I bought Jan. 1st, £5000 Consols at $92\frac{3}{8}$; I sold Feb. 10th, £1500 of this stock at $93\frac{7}{8}$, March 12th, £2000 at 93, and the remainder April 1, at $92\frac{5}{8}$, brokerage $\frac{1}{8}$ % on each transfer. Find my total gain or loss, supposing that I could have made 5 % per annum by other investments.

(15) I invested £2460 in the 3 per cents. at $90\frac{3}{8}$, with $\frac{1}{8}$ % brokerage; on their falling to $87\frac{1}{2}$, I sold out, paying again $\frac{1}{8}$ % brokerage, and put my money out on a mortgage at $4\frac{1}{2}$ %. Find the alteration in my capital and in my yearly income.

(16) I bought £5000 stock at $88\frac{1}{2}$. At what price must I sell *it to gain £100?*

(17) If I buy at 85, at what price must I sell to make $12\frac{1}{4}$ % profit, brokerage $\frac{1}{8}$ on each transaction?

(18) I invested money in the 3 per cents. at $75\frac{3}{8}$, and after drawing half a year's dividend, I sold out at a rise of $1\frac{7}{8}$ %, increasing my capital altogether by £91. 2*s.* 6*d.* How much did I originally invest?

(19) I invested in the 3 per cents. at $89\frac{1}{2}$, brokerage $\frac{1}{8}$. How much stock did I purchase, and what was the broker's commission, if I paid for investment and commission £410?

(20) The issue price of certain railway shares was £50, to be paid in five instalments of £10 each, the first payment on application. After a "call" or second payment of £10, the shares stood at £1 per share premium. I then invested £756, and after paying a further call of £10, a dividend was declared of $8\frac{1}{2}$ % per annum on the paid-up capital. What is the amount of my dividend, and what interest do I get for my money?

(21) A friend lent me £475 at 4 %; but to raise the money he sold out 3 per cent. Consols when they were at $87\frac{5}{8}$ (brokerage $\frac{1}{8}$). I kept the money three months, and meanwhile the funds rose to $91\frac{1}{2}$. How much have I to pay my friend to cover the interest and to replace the stock he previously held (brokerage again $\frac{1}{8}$)?

EXERCISE LXIII.

Find square roots of:

(1) 4.	(8) 289.	(15) 285970396644.
(2) 49.	(9) 3249.	(16) 501264.
(3) 100.	(10) 15129.	(17) 1607448649.
(4) 900.	(11) 582169.	(18) 41605800625.
(5) 160000.	(12) 61009.	(19) 9610000.
(6) 25000000.	(13) 956484.	(20) 123454321.
(7) 169.	(14) 68492176.	(21) 2892816758847744.

(22) A general arranges 8649 men in a solid square; how many men are there in each line?

(23) What is the length of the side of a square field 10 acres in extent?

EXERCISE LXIV.

(1) A miser wished to arrange 5000 sovereigns in a square. What would be the length of each side, and how many sovereigns would be over?

(2) How many more sovereigns would he want to have one more sovereign in each side of the square?

(3) What must be subtracted from each of the following numbers to leave for remainder the greatest square each contains: 8000, 80000, 3492, 75912, 25601?

(4) Find the next exact square below 56135, 82060, 10000000, 123456789, 777777, 4853741.

EXERCISE LXV.

I. Find the square root to 4 places of:

(1) 3. (2) 19. (3) 11. (4) $5\frac{1}{8}$. (5) $7\frac{3}{10}$.

II. Find to 8 places the square root of:

(1) 2, ·2, ·02, ·002.

(2) 16, 1·6, ·16, ·016, ·0000016.

(3) $\cdot 1\dot{6}$, $\cdot \dot{1}\dot{6}$, $\cdot \dot{0}1\dot{6}$.

(4) $\cdot \dot{4}$, $\cdot \dot{1}9753086\dot{4}$, $\cdot 02\dot{7}$.

III. Find by vulgar fractions and by decimals to 4 places the square root of:

(1) $3\frac{1}{16}$. (2) $1\frac{64}{225}$. (3) $51\frac{21}{25}$. (4) $15\frac{10}{81}$.

IV. Find to 12 places the square root of:

(1) $\frac{5}{8}$. (2) $\frac{7}{19}$. (3) $\frac{9}{1700}$. (4) $\frac{1}{2}$. (5) $\frac{1}{8}$. (6) $\frac{1}{30}$. (7) $\frac{1}{300}$. (8) $\frac{1}{400}$. (9) $\frac{1}{4000}$. (10) $\frac{5}{317}$.

V. Simplify to 3 places:

(1) $\sqrt{59} + \sqrt{\frac{7}{8}}$.

(2) $\sqrt{\cdot 2} - \sqrt{\cdot 2}$.

(3) $\sqrt{144^2 + 17^2}$.

(4) $\sqrt{113^2 - 112^2}$.

(5) $\sqrt{1 + \sqrt{3}}$

(6) $\sqrt{2 - \sqrt{2}}$

(7) $\frac{1}{\sqrt{2}}$.*

(8) $\frac{2}{\sqrt{11}}$.

(9) $\frac{1}{\sqrt{\cdot 001}}$.

(10) $\sqrt{5 + \sqrt{5 + \sqrt{5}}}$

* $\frac{1}{\sqrt{2}} = \frac{\sqrt{1}}{\sqrt{2}} = \sqrt{\frac{1}{2}} = \sqrt{\cdot 5}$, which find.

VI. Find x from the following (3 places):

(1) $45 : x = x : 80$.

(2) $1 : x = x : 2$.

(3) $x : 20 = 245 : x$.

(4) $1\frac{13}{35}$, x, $8\frac{4}{7}$, three numbers in G.P.

Exercise LXVI.

The following require a slight knowledge of Geometry. Results to be found to 4 places:

(1) A rectangular room is 24 ft. long and 18 ft. broad. Find the diagonal of the floor.

(2) A tower is 180 ft. high; I stand 19 ft. away from the base. How far am I in a straight line from the top of the tower?

(3) The disc of a pendulum 85 inches long touches in its sweep two points, A and B, which are in the same horizontal line, and are 1 inch above the lowest position of the disc. How far are they apart?

(4) In the 3rd question, suppose the length of the pendulum to be 41 inches, and A and B to be 18 inches apart, how far are they above the lowest position of the disc?

(5) How long must a ladder be to reach to the top of a house 60 ft. high, when its foot is placed 11 ft. from the wall?

(6) Given in a right-angled triangle:

a. Hypotenuse 200, base 70; find perpendicular.

b. Hypotenuse 1, perpendicular $\frac{1}{\sqrt{2}}$; find base.

c. Base $\sqrt{3}$, perpendicular 1; find hypotenuse.

(7) The foot of a column 200 ft. high is 300 ft. from the base of a house 75 ft. high. Find the distance of the top of the column from the top of the house.

(8) Find the diagonal of a square whose side is 100 feet.

(9) Find the side of a square whose diagonal is 100 feet.

(10) Find the length of the perpendicular from the vertex to the base of an equilateral triangle whose side is 100.

(11) Find the side of an equilateral triangle, if the perpendicular from the vertex is 100.

(12) Find the side of a square equal to a rectangle whose sides are 588 and 507 feet.

EXERCISE LXVII.

Find the cube root of:

(1) 68921.	(4) 592704.	(7) 3375.
(2) 110592.	(5) 389017.	(8) 10648.
(3) 205379.	(6) 300763.	(9) 54872.

EXERCISE LXVIII.

I. Find the cube root of:

(1) 884736.	(5) 115145914625.
(2) 40353607.	(6) ·017173512.
(3) 1191016.	(7) ·000000004096.
(4) 8108486729.	(8) ·000064481201.

II. Find the cube root (to 4 places) of:

(1) $\frac{343}{512}$.	(3) $\frac{12}{27}$.	(5) $\frac{5}{6}$.	(7) $\frac{6}{7}$.	(9) ·01.
(2) $\frac{1}{729}$.	(4) $\frac{41}{32}$.	(6) $15\frac{2}{3}$.	(8) ·1.	(10) ·001.

III. (1) If 12167 dice are piled up into a solid cube, how many dice will there be in each edge?

(2) Find the area of the surface of a cube whose volume is 3 cubic yds., 10 ft., 216 in.

EXERCISE LXIX.

(1) Express 73 lbs., 12 oz. av. in:

a. Kilogs. *c.* Austrian pounds.
b. Russian pounds. *d.* Prussian pounds.

(2) Express 25·625 French tons as:

a. English tons. *b.* Russian packen.

(3) Find the cost in English money per yd. at fr. 2·45 per metre.

(4) " " per cwt. at fr. 16·75 per quintal.

(5) " francs per French ton at 14*s.* 9*d.* per Engl. ton.

(6) How many litres in $4\frac{1}{2}$ Austrian eimer?

(7)*The average height of the barometer at Paris is 76 centimetres. Reduce this to inches correctly to three places of decimals.

(8) Reduce the hectare to a. r. po. yds. exactly. By how much does it differ from $2\frac{1}{2}$ acres?

(9) Supposing the quadrant of the meridian of Paris to be 6213 m., 6 fur., 23 po., 4 yds. in length, calculate the length of the metre in inches to five places.

(10) The French post-office allows 7·5 grammes for a single postage; the English $\frac{1}{4}$ of an oz. av. By how many grains does the French exceed the English allowance?

(11) How many hectolitres = 1 cubic metre? A tank is $37\frac{1}{2}$ decimetres long, by 25 wide and 18 deep. How many gallons would it hold?

(12) If wine be sold at 457 francs the cask of 7 hectolitres, what would be the corresponding price in *s. d.* of the bottle of 6 to the gallon?

(13) How many bushels = 1 hectolitre? If wheat be sold at 29 francs the hectolitre, what would be the corresponding price per bushel in *s. d.*?

(14) The length of the tunnel through Mont Cenis will be about 12·22 kilometres. What will this be in miles?

(15) The diameter of bore and weight of a piece of French ordnance are given as 27 centimetres and 22,000 kilogrammes. Give the corresponding measure and weight in inches and cwt.

(16) A building plot in Paris is offered for sale at 75 francs per sq. metre. What would be the corresponding price per sq. yard in £. *s. d.*?

(17) The distance between two stations on a Belgian railway is set down as $7\frac{1}{2}$ kilometres, and is done by a train in 12 minutes. What is the rate per hour in miles?

* Nos. 7 to 20 are copied from an excellent tract on the Metric System, by J. J. Walker, Esq., M.A.

(18) The pressure of the atmosphere at the average height of the barometer is $14\frac{3}{4}$ lbs. av. to the sq. inch. What would be the corresponding pressure in kilogrammes to the square centimetre?

(19) If the sack of flour of 157 kilogrammes be sold at 53·75 fr., what would be the corresponding price of the quartern (4 lbs.) in *s. d.*?

(20) The rent of a farm of 23·25 hectares is 1225 francs. What is the rate per acre in £. *s. d.*?

Exercise LXX.

Simplify:

(1) $\{3 \times (49993 + 2 \times 3997)\} + 9998.$

(2) $\{9 \times (49993 - 2 \times 3997)\} \times 9998 \times 701.$

(3) $793{\cdot}7\dot{1}\dot{8} \times 3{\cdot}997.$

(4) $\cdot\dot{1}5384\dot{6} \times 3{\cdot}9.$

(5) $\cdot\dot{3}8461\dot{5} \times 91000.$

(6) By synthetic division (integral):

a. $7473684 \div 19, 29, 39, 49, 59.$

b. $226543817 \div 199, 4999, 399, 3990$

c. $8543764333 \div 99, 999, 9999.$

d. $4623814 \div 98, 997, 9996.$

e. $54376146 \div 983, 9799, 9898.$

(7) Decimalize by synthetic divison, completing the period: $\frac{319}{41}$, $\frac{5284}{13}$, $\frac{5284}{17}$, $\frac{5284}{19}$, $\frac{5284}{23}$, $\frac{5284}{31}$, $\frac{5284}{47}$, $\frac{5284}{495}$, $\frac{5284}{2997}$.

(8) To 12 places: $73 \div 9995$; $47 \div 989$; $119 \div 9992$.

MISCELLANEOUS EXAMPLES.

(Answers to money sums to be brought to the nearest farthing; other problems to three places, unless otherwise specified.)

(1) By vulgar fractions and by decimals, work the following, and shew that the results coincide:

a. $8\frac{7}{20} + 3\frac{11}{25} + 9\frac{4}{5} + 10\frac{3}{8} + 4\frac{15}{32}$.

b. $6\frac{3}{5} - 3\frac{15}{32}$.

c. $\frac{3}{8} \times \frac{1}{10} \times 2\frac{1}{2} \times \cdot 001$; $\frac{5}{16} \times \frac{1}{8} \times \frac{1}{25} \times 1000000$.

d. $14 \div 3\frac{1}{5}$; $2\frac{1}{2} \div \frac{8}{25}$; $\frac{1}{4} \div \frac{2}{625}$.

(2) Find the limits of the following:

$\cdot 13\dot{5}$, $\cdot 1\dot{5}\dot{3}$, $\cdot 013\dot{5}$, $\cdot 21\dot{3}\dot{5}$, $\cdot \dot{0}13\dot{5}$, $\cdot 013\dot{5}$, $\cdot 015\dot{3}$.

(3) By decimal calculations only, find the following:

a. The cost of $5437\frac{5}{12}$ articles at £1. 13*s.* $10\frac{1}{4}$*d.* each.

b. " 287694 articles at $9\frac{5}{16}$*d.* each.

c. " 157 tons, 13 cwts., 2 qrs., 13 lbs., at £38. 10*s.* 8*d.* per ton.

d. The dividend on £347. 18*s.* 10*d.*, at 13*s.* $9\frac{7}{8}$*d.* in the £.

e. The profit on £468. 17*s.* 5*d.*, at £9. 13*s.* $4\frac{1}{4}$*d.* per cent.

f. The brokerage on £1267. 10*s.*, at $2\frac{1}{2}$ per mille.

g. The premium on £768, at $3\frac{1}{8}$ per cent., insured so as to recover both goods and premium in case of loss.

(4) Extract the square root of 191810·713444.

(5) Find to 4 places the difference between the square and cube roots of 32·14.

(6) Find to 3 places $2 \times \sqrt{3} - \frac{1}{2} \times \sqrt{12} + \sqrt{27}$.

(7) Prove that $\sqrt{18\cdot\dot{7}} = 4\frac{1}{3}$.

(8) Find the discount, the simple interest, and the compound interest, on £465 for 18 months at $4\frac{1}{2}$% (compound interest calculated half-yearly).

(9) Find a fourth proportional to $1\frac{1}{2}$, ·09, $\frac{9}{20}$.

(10) Shew that $\frac{1}{2600}$ of £10. 16*s.* 8*d.* is equal to ·002 of £2. 1*s.* 8*d.*, and that ·001 of £2 $= \frac{1}{2\cdot083\dot{3}}$ of 1*d.*

(11) Reduce to a decimal : $\cfrac{3}{4+\cfrac{2}{3+\cfrac{2}{3}}}$

(12) Extract the square root of 272·316004.

(13) Extract to 9 places the square root of ·034.

(14) Sum the series $1 + \frac{3}{2} + 2 + \frac{5}{2} + \ldots$ to 30 terms.

(15) Sum the series $\frac{387}{1000} + \frac{387}{1000000} + \frac{387}{1000000000}$ to infinity.

(16) A can dig a certain ditch in 3 days, B in 4 days, and C in 5 days. How long will it take the three together to dig the ditch, and what fraction of it is dug by each?

(17) Find the amount at compound interest at $12\frac{1}{2}$ % on £819. 4*s.* for 6 years, reckoned yearly.

(18) Extract to 5 places the cube root of $\cdot0\dot{3}\dot{4}$.

(19) If the carriage of 1 cwt., 12 lbs. for 105 miles comes to 3*s.* $10\frac{1}{2}$*d.*, what should be charged for the carriage of 8 cwt., 1 qr., 24 lbs. for 245 miles?

(20) Simplify $\frac{5\frac{3}{5}}{7\frac{1}{3}}$ of $\frac{21\cdot25}{\cdot046875}$.

(21) Find in what time £452. 10*s.* will amount to £644. 16*s.* 3*d.* at $4\frac{1}{4}$ % per annum simple interest.

(22) Express £4. 6*s.* $4\frac{3}{4}$*d.* + $\frac{1}{5}$ of 1 farthing as a decimal of £5.

(23) A grocer mixes 3 cwt., 15 lbs. of sugar at $5\frac{1}{2}$*d.* per lb. with 10 cwt., 10 lbs. at 4*d.* per lb. At what price per lb. should he sell the mixture to gain 25 %?

(24) Find G.C.M. and L.C.M. of 6·3375, 73·125, 39, 12·1875.

(25) Find the cost of 6 reams, 13 quires, 10 sheets, at £1 per ream.

(26) A man who has $\cdot\dot{3}$ of the profits of a partnership sells ·25 of his share, and the buyer makes £89. 6*s.* 8*d.* per annum. What is the yearly income of the whole business, and if the buyer pay £1000 for his share, what interest does he get for his money?

(27) Sum the series:

a. $2+5+8+11+$ to 20 terms.

b. $3+\frac{3}{10}+\frac{3}{10^2}+$ to 10 terms.

(28) One sample of tea costs 3*s.* 4*d.* per lb., and another 4*s.* per lb. At how much per lb. must the mixture of 60 lbs. of the former and 25 lbs. of the latter be sold to gain $7\frac{1}{2}$ %?

(29) Find the side of a square grass plot which is of the same area as a rectangular grass plot 63 ft. long and 28 ft. broad.

(30) Find the difference between the simple and compound interest reckoned yearly, on £210 for 2 years at 5 %.

(31) Find the difference to 3 places between $\sqrt[3]{3}$ and $\sqrt{2}$.

(32) A carpenter makes 2 chairs in 3 days, and 3 chairs and 1 table in 8 days. In what time would he make 6 chairs and 3 tables?

(33) A man walks 80 miles; he begins by walking 4 hours a day, at the rate of 5 miles an hour, and each day increasing the number of hours by 1, he diminishes the pace by 1 mile per hour. How many hours does he walk, and how many days?

(34) If a model of a cathedral is to be made on the scale of 6 ft. to $\frac{3}{4}$ of an inch, what will be the dimensions in the model of a tower 120 ft. high, a roof 50 ft. long, and a floor 40 square yards in area?

(35) Simplify:

a. $\left\{\frac{3}{5}\div\left(\frac{4}{25}-\frac{1}{9}\right)\right\}+\left\{1\div\left(\frac{2}{5}-\frac{1}{3}\right)\right\}-\left\{1\div\left(\frac{2}{5}+\frac{1}{3}\right)\right\}$

b. $\left(\frac{2}{3}+\frac{\frac{4}{5}-\frac{2}{3}}{1+\frac{2}{15}}\right)\times\frac{5}{6}\div\left(1-\frac{2}{3}\times\frac{\frac{4}{5}-\frac{2}{3}}{1+\frac{2}{15}}\right)$

c. $\dfrac{\frac{2}{3}\times\sqrt{3}\times\frac{1}{2}\times\sqrt[3]{2}}{\frac{5}{8}\times\sqrt[3]{2}\times\frac{3}{7}\times\sqrt{3}}$

(36) The items of a journey on the continent are £4. 10*s.* 6*d.*, 50·75 francs, 66 thalers. Find the whole cost of the journey in English, French and German money, when £1 = 25·22 francs = $6\frac{2}{3}$ thalers.

(37) In the morning I solved $\frac{3}{4}$ of $\frac{1}{3}$ of a certain number of problems; by the end of the afternoon I had done $\frac{2}{5}$ of $\frac{2}{3}$ of the number. Suppose the whole number of problems to be 300; how many did I solve during the afternoon?

(38) Multiply and divide to 4 places $\cdot\dot{3}8095\dot{2}$ by $1\cdot\dot{3}$, and verify the results by reducing the decimals to their limits.

(39) How much 3 per cent. stock must I sell out to pay a debt of £550, the price of stock being $94\frac{1}{8}$, and brokerage $\frac{1}{8}$ %?

(40) Find accurately the value of:

a. £·003, £·00$\dot{3}$, £·0$\dot{0}\dot{3}$, and £·00$\dot{3}$.
b. ·08$\dot{3}$, ·0$\dot{8}\dot{3}$, ·$\dot{0}$8$\dot{3}$ of a ton.
c. ·41$\dot{6}$, ·$\dot{4}$1$\dot{6}$ of 1 lb. troy.
d. ·0099, ·00$\dot{9}$ of 1 lb. av.
e. ·1$\dot{0}\dot{8}$, ·11$\dot{8}$ of 1 gallon.

(41) Find the reciprocal of the difference between 31·24 and 31·2376814285$\dot{7}$.

(42) Which is cheaper, to buy napoleons (20 fr.) at 15*s.* $10\frac{1}{2}$*d.*, or 25·22 fr. for a pound sterling.

(43) A kilogramme is 2·205 lbs. avoirdupois; a French ton = 1000 kilogs. What fraction of an English ton is a French ton?

(44) Find the difference between $5\frac{1}{2}$ sq. ft. and $5\frac{1}{2}$ ft. square.

(45) How much stock must I sell out of the Consols when they are at $93\frac{3}{4}$ (brokerage $\frac{1}{8}$), to raise a sum of £1265?

(46) Find the square roots (to 4 places of decimals) of 1979649, $7\frac{1}{8}$, $\frac{3}{7}$, ·25, ·35, ·000025, ·025, ·001.

(47) Find the cost of a case lined with tin, 5 ft., 10 in. long, 4 ft. broad, and 1 ft., 8 in. deep, inside measurement, at 2*d.* per sq. ft. for the wood, and $2\frac{1}{4}$*d.* per sq. ft. for the tin.

(48) If a napoleon be worth 15*s.* $10\frac{1}{2}$*d.*, find the lowest exact number of napoleons that must be given for an exact number of English sovereigns, stating the number of each.

(49) Simplify to 5 places of decimals:

$$\sqrt{1024} + \sqrt{102\cdot4} + \sqrt{10\cdot24} + \sqrt{1\cdot024} + \sqrt{\cdot001024}.$$

(50) Find the cost of papering a room 16 ft. long, 11 ft. wide, and 10 ft. high, with paper 30 inches broad, at $7\frac{1}{2}$*d.* a yard.

(51) Multiply (by the method of duodecimals) 7 ft., 5 in., 8 parts, by 9 ft., 4 in., 11 parts.

(52) Express the result of the last question as square inches.

(53) Arrange the following journeys in order of rapidity:

Name of Line.	Departure from London.	Arrival at		Distance.
Great Northern	10 a.m.	Aberdeen	3 a.m.	526 m.
Great Western	9.15 a.m.	Penzance	9.30 p.m.	328 m.
North Western	10 a.m.	Carlisle	6.10 p.m.	299 m.
Great Eastern	5 p.m.	Yarmouth	9.45 p.m.	146 m.
South Western	11.10 a.m.	Weymouth	4 p.m.	147 m.

(54) The fares for these journeys are £4, £3. 10*s.*, £2. 15*s.*, £1. 10*s.*, £1. 9*s.* 6*d.* respectively. Arrange them in the order of cheapness.

(55) What is the average charge per mile?

(56) If I invest 7000 guineas in the $3\frac{1}{2}$ per cents. at 93, what is my nett income, deducting 5 % income-tax?

(57) A room costs £8 to paper. What would a room cost half as high again, half as long again, and half as broad again, with paper costing half what it did before per yd.?

(58) If 144 men can dig a trench 40 yds. long, $1\frac{1}{2}$ ft. broad, and 48 ft. deep, in 3 days of 10 hours each, how long must another trench, 5 ft. deep and $2\frac{1}{4}$ ft. broad, be, in order that 51 men may dig it in 15 days of 9 hours each?

(59) The discount on a sum due one year hence at 5 % per annum is £15. What is the sum?

(60) How many dice a third of an inch long can be packed into a box whose dimensions inside are 2, 3 and 4 ft. respectively?

(61) How many dice a third of an inch long can be packed into a cubical box $1\frac{1}{2}$ ft. long inside?

(62) Find the square root of ·308641975.

(63) A mass of lead ore weighing 800 grains troy, was found to contain ·6 grain of silver. What is the value of silver in one ton of the ore, at the rate of 5*s.* the oz. troy?

(64) If £24. 7*s.* $10\frac{1}{2}$*d.* be paid as income-tax on an income of £650. 10*s.*, what ought to be paid at the same rate on an income of £2450. 6*s.* 8*d.*? And at what rate in the £ is the tax levied?

(65) In how many years will £625. 10*s.* amount to £813. 3*s.*, at 4 % simple interest?

(66) Find the value of 159 cwt., 3 qrs., 22 lbs., at £2. 12*s.* 6*d.* per cwt.

(67) Add $\frac{1}{6}$ of a guinea, £$\frac{9}{32}$, $\frac{1}{20}$ of a crown, and $\frac{15}{16}$ of a shilling, and express the whole as a decimal of £1.

(68) What sum of money will at $4\frac{1}{4}$ % simple interest amount in $3\frac{1}{2}$ years to £1497. 4*s.* 1*d.*?

(69) If the price of 3 bushels of wheat is 16*s.* 9*d.*, find the price of 12 qrs., 2 bus., 1 peck.

(70) Find the cost of making a road, length 9 miles, 5 fur., 44 yds., at £25. 8*s.* 4*d.* per mile.

(71) In what time will a sum of money double itself at 5 %, (*a*) at simple interest, (*b*) at compound interest, reckoned yearly?

(72) If when wheat is 60*s.* a quarter the sixpenny loaf weigh 4 lbs., how much should be paid for 25 lbs. of bread when wheat is 40*s.* a quarter?

(73) What decimal of an English mile is an Indian league, of which 30 go to a degree (60 geographical miles), 1 geographical mile being 1·1508 English miles?

(74) A Russian gold ducat is worth 9*s.* 5*d.* sterling; 3 roubles make a ducat, and 100 kopeks 1 rouble. Find in English money the value of 315 ducats, 2 roubles, 80 kopeks.

(75) Gun-metal consists of 100 parts of copper and 11 of tin. How much of each metal will there be in a cannon weighing 3 tons, 9 cwt., 1 qr., 16 lbs.?

(76) Find the income arising from investing £740 in the 3 per cents. at $92\frac{1}{2}$.

(77) Reduce to lowest terms $\frac{403}{899}$, $\frac{5371}{59736}$.

(78) Find the sum of 19 terms of the series 7, 14, 21, &c.

(79) If a degree of longitude at X—— be $\frac{2}{3}$ of the length of a degree at the equator, how many miles at the latitude of X—— will the sun pass over in a minute and a half, given that the equator is 131470565 feet long?

(80) A ship's company take a prize of £1000, which is to be divided amongst them in proportion to their pay and to their time of service; the officers, 4 in number, have 40*s.* each a month, and the midshipmen, 12 in number, have 30*s.* each a month, and they have all served six months; the sailors, 110 in number, have each 22*s.* a month, and have served 3 months. Find each man's share.

(81) An Austrian bankrupt owes a London merchant 5784 florins, and pays $68\frac{1}{2}$ %. How much is that in the £, and how much sterling money will be remitted to the Englishman (exchange 11·45 fl. = £1)?

(82) The rent-roll of a certain estate amounts to £3580 a-year. The repairs average $7\frac{1}{2}$ % per annum. Find the value of the estate at 28 years' purchase.

(83) Which is the heavier income-tax, 3 % or 7*d.* in the £?

(84) A steamer working with a given force can travel down the river at the rate of $12\frac{1}{2}$ miles an hour. Of this speed, $\frac{2}{7}$ is due to the current. How long would the steamer take to travel 15 miles up the stream?

(85) Find the rent of 204 acres, 1 rood, 20 poles, at £2. 15*s.* 9*d.* per acre.

(86) Find the *discount* on £972, due 10 months hence, at $5\frac{1}{4}$ % per annum, and shew what rate of *interest* is charged in this case.

(87) If the rations of 3264 men for 48 days cost £4787. 4*s.*, what is the cost of the rations of 5000 men for 90 days?

(88) Two persons have invested £11. 17*s.* $2\frac{3}{4}$*d.* and £17. 16*s.* $8\frac{1}{2}$*d.*, and the return is £46. 2*s.* $0\frac{3}{4}$*d.* Find within a farthing what the share of each must be.

(89) Of £121. 13*s.* $4\frac{3}{4}$*d.* and £29. 8*s.* 10*d.*, what percentage is each of the other (5 places)?

(90) Determine without any superfluous work $\sqrt{1{\cdot}0097626}$ to 8 places.

(91) Find correct to one 10,000th of a unit $16{\cdot}112734 \times {\cdot}20708 \times 1146{\cdot}339 \div {\cdot}00007$.

(92) A ship valued at £14,500 is insured at £3. 10*s.* %, and her cargo valued at £32,000 is insured at £4. 17*s.* 6*d.* %. Find the whole cost of insurance.

(93) I invested £680 in Consols at $89\frac{3}{8}$; 3 days later the funds rose to $90\frac{7}{8}$. What would have been my loss of income had I waited these 3 days, brokerage $\frac{1}{8}$ %?

(94) A speculator bought in Consols at $88\frac{3}{8}$, and sold out at $91\frac{3}{4}$, brokerage $\frac{1}{8}$ % each time; his total gains amounted to £350. Find the value of the stock when bought in.

(95) I bought $3\frac{1}{2}$ per cent. stock at $95\frac{1}{2}$, and after drawing one half-yearly dividend, I sold at $92\frac{7}{8}$; my total loss of capital amounted to £8. 15*s*. Find the amount of stock I had held.

(96) The prices of the 3 per cent. Consols, and Midland Railway Stock, paying $5\frac{1}{4}$ %, were quoted at $95\frac{3}{8}$ and $108\frac{1}{2}$ respectively. Find the difference in income from investing £100 in each.

(97) Find the average of $17\frac{1}{2}$, $25\frac{1}{4}$, $96\frac{3}{8}$, 10, 0, $42\frac{3}{4}$, 56, and express the answer decimally.

(98) The income of a parish is £6529. 10*s*. 6*d*. How much in the £ will produce a rate of £150?

(99) If the time after 1 p.m. is $\frac{7}{15}$ of the time before midnight, what o'clock is it?

(100) Find cube root of $1776\frac{325}{729}$.

(101) Express 1 acre, 3 roods, 26 perches, as the decimal (in full) of a square mile.

(102) If 120 men make an embankment $\frac{3}{4}$ of a mile long, 30 yards wide, and 7 yds. high, in 42 days, how many men would it take to make an embankment 1000 yds. long, 36 yds. wide, and 22 ft. high, in 30 days?

(103) A person invests £1365 in the 3 per cents. at 91; he sells out £1000 stock when they have risen to $93\frac{1}{2}$, and the remainder when they have fallen to 85. Find his gain or loss.

(104) A and B have gained £600 between them; A has to receive 10 % less than B. Find their respective shares.

(105) Distribute £1250 among A, B and C, giving to A 15 % more, and to B 12 % less than to C.

(106) Distribute £760 among A, B and C, giving to A $17\frac{1}{2}$ % less than B's share, which is 20 % more than C's share.

(107) A bankrupt's estate amounts to £910. 3*s.* $1\frac{1}{2}$*d.* and his debts to £1875. What can he pay in the £, and what will a creditor lose on a debt of £57?

(108) An estate with a rental of £8790 is sold for £351,600 In order that it may yield the purchaser $3\frac{3}{4}$ % for his money, how much % must he raise the rent?

(109) A square court-yard costs £38. 10*s.* 5*d.* to pave, at 3*s.* 9*d.* per square yard. Find the length of its side.

(110) Express 37048 (decimal) in the nonary scale; also 347102 (nonary) in the decimal scale.

(111) The Hanoverian mile is 25400 Hanoverian feet long, each foot being ·9542 English feet. Find to 4 places of decimals the fraction that an English is of a Hanoverian mile.

(112) How many times will a wheel whose diameter is $3\frac{2}{7}$ feet revolve in travelling over 5 miles? (N.B. Circumference : diameter = 3·14159 : 1.)

(113) If a package weighing 7·5 cwts. be carried 125 miles for 14*s.* 7*d.*, how much will be charged for the carriage of 3 tons, 15 cwts. for a distance of 200 miles?

(114) If 770 gallons of creosote at 1*d.* per gallon have the heating power of 8·75 tons of coal at £·641$\dot{6}$ per ton, find the yearly saving in money in a factory which burns 1000 gallons a day, omitting 52 Sundays.

(115) Extract the square root of 1194·3936 and of $\frac{14\cdot4}{16\cdot9}$.

(116) Simplify:

$$\frac{\frac{5}{2}\times\frac{1}{1\frac{1}{4}}+1\frac{5}{7}\text{ of }\frac{1}{\frac{4}{7}}}{8}+\frac{\frac{21}{3\frac{1}{3}}\times\frac{5}{18\frac{3}{4}}\times37\frac{1}{2}}{\frac{\frac{1}{2}+\frac{1}{5}}{\frac{1}{2}\times\frac{1}{5}}}-\left(\frac{1}{7}\text{ of }\frac{25}{3\frac{1}{7}}\text{ of }\frac{3\frac{1}{3}}{6\frac{3}{4}}+\frac{1}{14}\text{ of }\frac{1}{1\frac{1}{3}}\right)$$

(117) Express + 40° and − 40° Fahrenheit on the Centigrade and Réaumur scales.

(118) Find the cost of $3047\frac{5}{11}$ articles at £1. 15*s.* $9\frac{1}{2}$*d.* each.

(119) What capital will at $3\frac{1}{2}$ % in three months amount to £348. 0*s.* $4\frac{1}{2}$*d.*?

(120) A bankrupt's debts amount to £27485. 10*s.* 9*d.* and his assets are worth £9328. 6*s.* 3*d.* What is he to pay on each of the following debts: £248. 14*s.* 5*d.*; £7642. 10*s.* 6*d.*; £19. 4*s.* 2*d.*?

(121) Find the cost of 47 iron plates, each weighing 127 tons, 13 cwt., 1 qr., 19 lbs., at £50. 6*s.* 10*d.* per ton.

(122) Find the value of 21 acres, 2 roods, 15 perches, at £37. 15*s.* 6*d.* per acre.

(123) If the sixpenny loaf weigh 4·35 lbs. when wheat is at 5·75 shillings per bushel, what weight of bread ought to be purchased for 18·13 shillings when wheat is at 18·4 shillings per bushel?

(124) Three gardeners working full time can plant a field in 10 days. How long will it take them if one of them works half time?

(125) A person bought into the 3 per cents. at 98, and after receiving 3 years' interest sold out at 90. How much % on the sum invested did he gain or lose?

(126) A Turkey carpet measuring 12 ft., 6 in., by 11 ft., 6 in., is laid down on the floor of a room measuring 14 ft. by 13 ft. Determine the quantity of floorcloth necessary to complete the covering of the floor, and its price, at 4*s.* per square yard.

(127) Reduce 9*s.* $11\frac{3}{4}$*d.* to the fraction of half-a-sovereign.

(128) Simplify $\frac{1\cdot18}{\cdot152} \times \frac{3\cdot04}{2\cdot95} \div \cdot00125$.

(129) Find the cost of 457 tons, 13 cwt., 3 qrs., 19 lbs., at £5. 17*s.* $8\frac{1}{2}$*d.* per ton. Also of 17 lbs., 9 oz., 17 dwts. troy, at £3. 15*s.* $10\frac{1}{4}$*d.* per oz.

(130) Find the compound interest for £55 for 1 year, reckoned quarterly, at 5 % per annum.

(131) Find, without unnecessary work, to 3 places:

a. $\cdot40\dot{0}8\dot{6} \times 16\cdot0\dot{5}\dot{9} \times 2618\cdot0\dot{8}5\dot{3} \times \cdot00035$.

b. $\cdot4\dot{1}\dot{9} \times 9\cdot8 \times 720 \times 43\cdot1\dot{5}\dot{6}$.

c. $3\cdot1415926536 \times \sqrt{7000} \times \sqrt[3]{\tfrac{1}{3}} \times 1870$.

(132) Find the difference between the square and cube roots of 3915380329 (to 1 place).

(133) Simplify $\sqrt{25\tfrac{44759}{117649}} - \sqrt[3]{25\tfrac{44759}{117649}}$. Also find the value of $\sqrt[3]{\cdot000729} - \sqrt{\cdot000729}$; and explain why the sign $\sqrt{\ }$ is placed first in one case, and $\sqrt[3]{\ }$ in the other.

(134) A buys 134 gallons of beer for £11. 18*s.*; 6 gallons are lost by leakage; he sells the rest in jugs, holding $\frac{3}{8}$ of a quart, at $2\frac{1}{4}$*d.* per jug. Find his total profit, and his profit %.

(135) The receipts of a railway company are apportioned in the following manner: 49 % for working expenses, 10 % for the reserve fund, a guaranteed dividend of 5 % on one-fifth of the capital, and the remainder, £40000, for division among the holders of the rest of the stock, being a dividend of 4 % per annum. Find the capital and the receipts.

(136) Find the square root of 24·2064; of 3124·81; of $2{\cdot}42064 \times 312{\cdot}481$ and of $\frac{2{\cdot}42064}{312{\cdot}481}$.

(137) Find the cost of paving a hall 50 yds. long by 50 ft. broad, with marble slabs 1 ft. long and 9 in. broad, the price of the slabs being £5 per dozen.

(138) Simplify $\frac{{\cdot}0075 \times 2{\cdot}1}{{\cdot}0175} + \frac{4{\cdot}255 \times {\cdot}0064}{{\cdot}00032}$.

(139) Find the square root to 8 places of decimals of 38715, 1500, 150, 7, ·7, ·07, 49, 4·9, ·49, ·4$\dot{9}$, ·3402$\dot{7}$.

(140) The quadrant is divided into 90^0 and also into 100 grades. Express $37\frac{1}{3}$ deg. + $50\frac{2}{9}$ gr. both as degrees and as grades.

(141) A person having £1000 invests in the 3 per cents. at $92\frac{3}{8}$, brokerage $\frac{1}{8}$; after 3 years he sells at $94\frac{5}{8}$, and again pays $\frac{1}{8}$. What did he receive as interest, and what did he gain on the whole?

(142) Divide £26. 3*s.* 3*d.* between 3 persons so that their shares may be in the proportion of £2. 18*s.* 6*d.*, £1. 19*s.* and £1. 9*s.* 3*d.*

(143) If the price of candles $8\frac{1}{2}$ inches long be 9*d.* per half-dozen, and that of candles of the same thickness and quality $10\frac{1}{4}$ inches long be 1*s.* $4\frac{1}{2}$*d.* for 9 candles, which is the cheaper kind, and how much % is lost by buying the dearer?

(144) Find the profit or loss per dozen on a quantity of wine "laid down" in 1848 at a cost of £2. 8*s.* per dozen, and sold in 1870 at £5. 5*s.* per dozen, reckoning compound interest annually at 5 %.

(145) Express ·$\dot{3}$ (in the quinary scale) as a decimal fraction.

(146) I sold goods at a loss of $7\frac{1}{2}$ %; had I sold them at a gain of $7\frac{1}{2}$ % I should have realized £3. 15*s.* more than I actually received. Find the cost of the goods.

(147) Multiply by duodecimals 9 ft., 7 in., 3 pts., by 5 ft., 7 in., 11 pts., and the product by 2 ft., 7 in. What does the product become when expressed in cubic feet and inches?

(148) In 1841 the population of Great Britain was 21,476,000, and that of Ireland 7,310,000; in 1851 the former had increased 8·45 % and the latter had decreased 12·5 %. Find the increase % in the population of the United Kingdom.

(149) Reduce $\frac{68}{157}$ to a converging fraction; give the several convergents and the limit of error in each.

(150) A certain book costs in production 2*s.* $4\frac{1}{2}$*d.* per copy, and its retail price is 7*s.* 6*d.*; the publisher allows the bookseller 25 % on the retail price, and gives 13 copies to the dozen; 3900 copies are printed and sold; the author is to have half the profits. How much will he receive?

(151) A tenant pays a corn rent of 20 quarters of wheat and 12 of barley, Winchester measure. What is the value of his rent, wheat being at 60*s.* and barley at 54*s.* a quarter imperial measure, reckoning a Winchester bushel to be $\frac{32}{33}$ of an imperial bushel.

(152) Express as a decimal $\frac{117}{5^{11} \times 2^7}$.

(153) A certain Building Society accepts £11. 14*s.* 1*d.* at the beginning of the year in lieu of 12 monthly instalments of £1 each. What yearly payment will at this rate discharge a monthly liability of £5. 17*s.* 10*d.*?

(154) I wish to borrow of a Building Society £600, to be paid off in 15 years by monthly instalments, paying interest at 6 % on the whole sum borrowed for the whole time. What should be my *yearly* payment at £11. 14*s.* 1*d.* instead of £1 per month?

(155) I hold £43. 17*s.* 5*d.* Building Society stock for 7 months, and the year's balance sheet shews a dividend of £11. 13*s.* $8\frac{3}{4}$*d.* per cent. per annum. What dividend should I receive?

(156) A cistern holding 820 gallons is filled in 20 minutes by 3 pipes, the first of which conveys per minute 10 gallons more, and the second 5 gallons less, than the third. How much flows through each pipe per minute?

(157) Gold is 19·3 times, and copper is 8·62 times as heavy as water. How many times as heavy as water is standard gold, which is a mixture of 11 parts of gold and 1 of copper?

(158) The annual retreat of the equinox along the ecliptic is 50″. In what time will the equinox be carried round the whole circle of the ecliptic (360^0)?

(159) In what time will the sun move through 50·1″, when it traverses 360^0 in 365 days, 6 hours, 9 min., 9·6 sec., the motion being supposed uniform?

(160) A bankrupt's stock was sold for £520. 10*s.*, at a loss of 17 % on the cost price. Had it been sold in the course of trade, it would have realized a profit of 20 %. How much was it sold below the trade price?

(161) A foreign Government contracts for three loans in different markets: the first, a 5 % loan for 20 millions; the second, a 4 % loan for 12 millions; the third, a $3\frac{1}{2}$ % loan for 10 millions. For the first the Government received £65, for the second £50, for the third £42 for every £100 stock. How much money does Government receive for all these loans, what average rate of interest is paid on the money actually received, and on which of the three loans does the Government pay the lowest rate of interest?

(162) A besieged garrison loses 5 men on the first day, 10 on the second, 15 on the third, and so on for 30 days, when the commandant, finding that he had only $\frac{1}{4}$ of his original garrison left, surrendered. How many men were there at first?

(163) A merchant sells tea to a tradesman at a profit of 60 %, but the tradesman becomes bankrupt and only pays 13*s.* 4*d.* in the £ How much per cent. does the merchant gain or lose?

(164) Find the sum which must be invested in the 3 per cents. at 90, to amount in $23\frac{1}{2}$ years to £3317 sterling, the price of the funds remaining unchanged. If we sold out at 96, how many years sooner could the required amount be realized?

(165) The sidereal year consists of 365 days, 6 hours, 9 minutes, 9·6 seconds, reckoned in mean solar time, or of 366 days, 6 hours, 9 minutes, 9·6 seconds, reckoned in sidereal time. Find the ratio of a sidereal to a solar day, to 5 places.

(166) Two shepherds, A and B, owning a flock of sheep, agree to divide it; A takes 144 and B 184 sheep, paying £70 to A. Find the value of 1 sheep.

(167) Among how many persons must £158. 17*s*. 3*d*. be divided, in order that half of them may have 10*s*. 7*d*. each, and the other half 7*s*. 2*d*. each?

(168) A and B have the same sum of money; A buys equal amounts of 3 per cent. stock at 91, and of $3\frac{1}{2}$ per cent. at $97\frac{1}{2}$; B invests his money equally in the purchase of the same stocks. A's income being 1*s*. more than B's, how much money had each?

(169) Assuming a cubic foot of water to weigh 1000 oz. av., find the weight of a rainfall of one inch over an acre of ground.

(170) A person has a sum invested in the 3 per cents., which he sells and invests in the $3\frac{1}{2}$ per cents. at $87\frac{1}{2}$. If his income remains the same, what was the price of the 3 per cents.?

(171) A takes 6 steps while B takes 7; but 4 of A's steps are equal to 5 of B's. Which is the quicker walker?

(172) An army lost 18 per cent. of its strength by disease and desertion, and then 14 per cent. of the remainder in battle; the number then remaining was 84,624. Of how many did it originally consist?

(173) A person sells £5000 Consols at $94\frac{7}{8}$, and on their rising he sells £5000 more at $95\frac{5}{8}$; on their again rising he buys back the whole £10000 at 96. What does he lose?

(174) If gold is 19·3 times as heavy as water, and copper is 8·96 times as heavy as water, how many times its own bulk of water will a crown weigh composed of 9 oz. of gold and 15 oz. of copper?

(175) Find by inspection (table, p. 152) the number of recurring and non-recurring figures in the decimalization of each of the following fractions: $\frac{1}{8}, \frac{1}{625}, \frac{1}{16\times25}, \frac{1}{2^{10}\times5^{10}}, \frac{1}{2^5\times5^3}, \frac{1}{7}, \frac{1}{56}, \frac{1}{91}, \frac{1}{21}, \frac{1}{7\times37}, \frac{1}{2\times5\times7\times37}, \frac{1}{13\times79}, \frac{1}{13\times41}, \frac{1}{19\times23}, \frac{1}{2\times3\times5\times7\times11\times13}$.

(176) If a mass of silver be worth £720,000 when silver is worth £4. 4*s.* per lb. av., how much would the mass be worth if silver fetched 13·75 shillings for 2·5 ounces troy?

(177) A, B and C begin playing with £1. 6*s.* each; A wins 5*s.* each game, and B loses $\frac{2}{15}$ of A's gains. After how many games will C have nothing left, and what will A then have?

(178) Reduce $\frac{222}{931}$ to a converging fraction, and give the several convergents with limits of error to each.

(179) I sold a watch for 5 guineas and thereby cleared 20 % of my money. How much % should I have gained or lost if I had sold it for $4\frac{1}{2}$ guineas?

(180) If the French 3 per cents. are at 60 when the English are at 95, the exchange between the countries being 25 fr. per £1, how much French stock in francs can be bought by selling £6000 out of the English funds?

(181) I bought silk at fr. 7·40 per metre (39·37 inches) and sold it for 6*s.* $10\frac{1}{2}$*d.* per yard. Find (to 2 places) my profit or loss %, the rate of exchange being fr. 25·35 = £1.

(182) I had a cistern 5 ft., 7 in. long, 3 ft., 11 in. broad, 2 ft., $8\frac{1}{2}$ in. deep, re-lined with zinc at $8\frac{3}{4}$*d.* per square foot; the plumber allowed me $\frac{7}{8}$*d.* per square foot for the old zinc. How much had I to pay?

(183) Find the length of a cubical tank holding 1 ton of water, if a cubic foot of water weighs 1000 oz. av.

(184) Find in two ways $\sqrt[6]{1061520150601}$.

(185) Find in two ways to 3 places $\sqrt[6]{7\cdot358}$.

(186) If a merchantman sailing $9\frac{1}{2}$ knots an hour is chased by a gunboat steaming $10\frac{3}{4}$ knots, how far ahead must the sailing vessel be just to escape into port from which she is $15\frac{1}{2}$ knots at the commencement of the chase?

(187) Divide £14. 11*s.* $8\frac{1}{2}$*d.* into two parts that shall have to one another the same ratio as the sum of $2\frac{5}{8}$ and $1\frac{4}{5}$ has to their difference.

(188) Also the same ratio as the product of the two numbers has to the quotient, the greater being divided by the less.

(189) Find the side of a square field an acre in extent (to tenths of a yard).

(190) The discount on a sum due 3 months hence at 5 % was £17. 10*s.* What is the sum?

(191) A grocer mixes 3 cwt. of tea at £16. 16*s.* per cwt. with 1 cwt. at £19. 12*s.* At what rate per lb. must he sell the mixture so as to gain 4 %?

(192) A person having invested a sum of money in the 3 per cent. Consols receives annually therefrom £233 after deducting the income-tax of 7*d.* in the £. How much stock does he hold, and how much will it be sold for, at $94\frac{1}{4}$, brokerage $\frac{1}{8}$.

(193) From 122·5 grains of chlorate of potash there can be obtained 48 grains of oxygen gas; 16 grains of oxygen occupy a space of 44·4 cubic inches. What volume of oxygen could be obtained from a ton av. of chlorate of potash?

(194) Find the length of the side of a cubical tank which contains 15 cwt., 7 lbs., 8 oz., of water, 1 cubic foot of which weighs 1000 oz.

(195) Which money sums will when decimalized yield recurring decimals? and how could you get rid of the recurring figure if required?

(196) How long will it take me to travel 5 Russian versts at the rate of $8\frac{1}{2}$ miles an hour?

(197) Find the sum to be awarded on £87. 13*s.* 10*d.* at £7. 15*s.* $9\frac{3}{8}$*d.* %.

(198) Express $\frac{224\cdot7}{365\cdot256}$ as a continued fraction, and find the five first convergents.

(199) After the outbreak of the Prusso-French war in 1870 the Prussian Government issued a 5 % war loan at 88; the French 3 per cents. stood at $65\frac{1}{2}$. State the ratio of the two rates of interest.

(200) If 9000 persons travelling each 20 miles a week pay a railroad company £900 in one week, how many persons travelling each 30 miles weekly will give a receipt of £62,400 a year when the charge for travelling per mile is reduced one half?

(201) Find the amount of the national debt from the following sums paid as annual interest:

£3 per cent. Consolidated Annuities.....	£11871403	10	0
£3 per cent. Reduced ditto	3188376	11	7
New £3 per cent. ditto	6633792	10	10
New £3. 10*s.* per cent. ditto	8426	2	4
New £5 per cent. ditto	21687	9	8
New £2. 10*s.* per cent. ditto	96176	7	0
Interest on the Government Debt to the Bank of England at 3%.....	330453	0	0
Ditto to the Bank of Ireland at 3 %.....	78923	1	6

(202) A bar of gold weighing 8·75943 kilogs., of which $\frac{19\cdot58}{24}$ is fine, is sent over from Paris, and sold here at £3. 17*s.* 9*d.* per standard oz., which is $\frac{22}{24}$ pure. How many francs must be remitted in payment, exchange being 25·35 fr.?

(203) Find the value of a bar of gold which weighs 11 lbs., 8 oz., 7 dwt., 12 grs., and is $\frac{21\frac{1}{2}}{24}$ pure at the rate of £3. 17*s.* 9*d.* per oz. standard.

(204) How many cubic yards of gravel will be required for a walk surrounding a rectangular lawn 200 yards long and 100 yards wide, the walk to be 3 yards wide, and the gravel 3 inches deep?

(205) Find (to two places) the side of a cubical block of cast iron weighing a ton, if iron weighs 7·2 as much as water, and a cubic foot of water weighs 1000 oz.

(206) A crown made of an alloy of copper and gold weighs 16·5 oz., while the water it displaces weighs $1\frac{1}{2}$ oz. How much copper does it contain, gold weighing 19·3 and copper 8·96 times as much as water?

(207) A grocer buys some tea at 4*s.* per lb. and some at 5*s.* 6*d.* In what proportion must he mix the two quantities so as to gain 20 % by selling the mixture at 6*s.* per lb.?

(208) Express ·583, ·58$\dot{3}$, ·5$\dot{8}\dot{3}$ and ·$\dot{5}8\dot{3}$ in the duodecimal scale to 5 places.

(209) I bought £333. 6*s.* 8*d.* 3 per cent. Consols for the benefit of an old servant, but wished to raise his income to £25 a-year by means of an investment in £50 mining shares, all paid up; the shares are at $8\frac{3}{4}$ premium, and the dividends are $7\frac{1}{2}$ % on the paid-up capital. How much mining stock must I buy, and what will it cost me?

(210) A Lithuanian league is 9769 yards long. Find the third convergent to the fraction that an English mile is of this.

(211) Express in inches the length of a French metre from the data that a metre is one ten-millionth of a quarter of the earth's circumference, and that the circumference is 3·14159 times the diameter 7911·7 miles.

(212) State:

a. Which vulgar fractions will yield recurring and which non-recurring decimal fractions.

b. If non-recurring, how the number of places can be foretold.

c. If recurring, whether the decimal will be mixed or pure.

(213) Find the value of a mass of silver weighing 15 lbs., 9 oz., 10 dwts., 20 grs., of which $\frac{14}{17}$ is pure, at the rate of $57\frac{7}{8}$*d.* per oz. standard silver. (Standard silver contains $\frac{11\cdot1}{12}$ pure silver.)

(214) If income-tax be 6*d.* in the £ and interest 5 %, how much do I gain or lose on an income of £1200 a-year by paying the whole year's tax at the end of the third quarter instead of paying it in 4 instalments at the end of each quarter?

(215) Express $\frac{3}{8}$ and $419\frac{1}{7}$ in the binary, ternary, quaternary, quinary, senary, septenary, octonary, nonary, decimal and duodecimal scales.

(216) Any two numbers whose units' figures are odd, but not 5, and whose difference is a power of 10, must be prime to one another. Prove this.

(217) If the wages of a woman are $\frac{4}{7}$ of the wages of a man, and it would require 8 men to earn a given sum of money, how many women must be added to 5 men to earn double the money? Explain your answer.

(218) Of the boys in a school, one-third are over 15 years of age, one-third between 10 and 15. A legacy of £100 can be exactly divided amongst them by giving 10*s.* to each boy over 15, 6*s.* 8*d.* to each between 10 and 15, and 3*s.* 4*d.* to each of the rest. How many boys are there in the school?

(219) Express the fraction $\frac{7}{25}$:

a. As a decimal fraction.

b. As a septenal fraction.

c. Also as a quaternal fraction.

(220) The mint price of gold is £3. 17*s.* 10½*d.* per oz. standard. Find the smallest exact number of ounces that can be coined into an exact number of sovereigns.

(221) Find the weight of a cubical mass of iron whose edge is 2 ft., 5 in., 3 pts., if the iron is 7·157 times as heavy as water, and a cubic foot of water weighs 1000 oz. av.

(222) How high is a hill whose ascent is $1\frac{7}{8}$ miles in length, if the road rises $\frac{1}{\frac{3}{7}}$ inches in 55·25 feet?

(223) A can copy 6 pages while B copies 5, B copies 15 while C copies 12, and C can copy 4 while D copies 3; A who can write 20 pages a day receives a paper of 240 pages to copy; and after doing a quarter of it calls in B, C and D to help him. When will the work be finished?

(224) A merchant buys 1260 quarters of corn, $\frac{1}{5}$ of which he sells at a gain of 5 %, $\frac{1}{3}$ at a gain of 8 %, and the remainder at a gain of 12 %; if he had sold the whole at a gain of 10 % he would have gained £23. 2*s.* more. What was the cost price per quarter?

(225) The sum of £10552. 4*s.* 2*d.* is divided among 1000 persons in the ratio of the first thousand natural numbers. Find the share of the 150th person.

(226) The diameter of the fore wheel of a waggon is 3 ft., 6 in., that of the hind wheel 6 ft., 5 in. If two nails, one on the outside of each wheel, touch the ground together, in how many seconds (to two places) will they do so again, reckoning diameter : circumference = 1 : 3·14159, and the rate of travelling $4\frac{1}{2}$ miles an hour?

(227) I bought in London \$1000 American 5-20 bonds at 87 (i.e. 87 × 4*s.* 6*d.* per \$100 bond). What percentage shall I get for my money if the coupons in New York fetch clear of expense 4*s.* $0\frac{1}{2}$*d.* per dollar, the bonds paying 6 %?

(228) I bought in New York \$1500 5-20 bonds, brokerage $\frac{1}{8}$, at 111, in (paper) currency; gold was $15\frac{1}{2}$ premium; I paid by bill upon England, and the rate of exchange was 110 (i.e. \$110 in gold for 100 × 4*s.* 6*d.* payable in England); I re-sold these bonds in England at 89 (see last question), brokerage $\frac{1}{8}$. Find my profit or loss.

(229) The first term of an A. P. is $\frac{1}{4}$, the common difference is $\frac{1}{2}$. Find the 50th term.

(230) Suppose a debt can be discharged in a year by paying 1*s.* the 1st day, 2*s.* the second, and so on. What is the amount of the debt?

(231) How many strokes do the clocks of Venice, which go on to 24 o'clock, strike in a day?

(232) Find $(47{\cdot}3\dot{1}8\dot{4})^6$ to 3 places.

(233) Find the equated time for the following amounts: £50 due in 6 months, £60 in 7 months, and £80 in 10 months, interest at 5 %, both by average and discount.

(234) A debt is to be paid as follows: $\frac{1}{4}$ at 2 months, $\frac{1}{8}$ at 3 months, $\frac{1}{8}$ at 4 months, $\frac{1}{8}$ at 5 months, and the balance at 6 months. What is the correct equated time to pay the whole, interest at 5 %?

(235) An island is 73 miles in circumference, and 3 pedestrians all start together to travel round it in the same direction; the first goes 15, the second 17·5, and the third 10 miles a day. When will all three be again together?

(236) A owes me the following sums: £480 due in $3\frac{1}{2}$ months, £607 due in 2 months, £577. 15*s.* due in 5 months. What sum should I accept as a single payment at the end of six months, reckoning interest at 4 %?

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(237) What effect is produced on (*a*) the sum, (*b*) the difference, of two numbers, if the same quantity is added to each?

(238) What effect is produced on (*a*) the sum, (*b*) the difference, of two numbers, if the same quantity is added to one and subtracted from the other number?

(239) What effect is produced on (*a*) the product, (*b*) the quotient, of two numbers, if both numbers are multiplied by the same number?

(240) What effect is produced on the remainder, if (*a*) the divisor, (*b*) the dividend, be increased by a number not large enough to affect the quotient?

(241) What effect is produced on the remainder, if both divisor and dividend are (*a*) multiplied, (*b*) divided by the same number?

(242) State the conditions of increase in the value of a fraction, if the same number be added to both its terms.

(243) What effect is produced on the ratio, if the antecedent is multiplied and the consequent divided by the same number?

(244) What effect is produced on the square of a number, if the number is increased by a given number?

(245) Find the difference between the sum of the squares and the square of the sum of two numbers.

(246) What effect is produced on (*a*) the sum, (*b*) the difference, of two numbers, if each is multiplied by the same number?

(247) What effect is produced on (*a*) the L.C.M., (*b*) the G.C.M., (*c*) the average, of several numbers, if each is multiplied by the same number?

(248) How must a number be altered to double its reciprocal?

(249) To what limits do the *terms* of the two following series approach:

a. $\frac{1}{2}, \frac{2}{3}, \frac{3}{4}, \frac{4}{5}, \ldots\ldots$ *b.* $\frac{1}{7}, \frac{2}{8}, \frac{3}{9}, \frac{4}{10}, \ldots\ldots$

and find the first term in each which differs from the limit by a quantity less than ·000001.

(250) To find the interest at 3 % per annum on any number of pounds for any number of days, multiply the number of pounds by twice the number of days, deduct $\frac{1}{70}$ of the product, and cut off the last two figures; the result will be the interest in pence. Shew that the error in the interest given by this rule for any time less than a year cannot exceed a shilling on every £2800 principal.

THE METRIC SYSTEM.

The Metre is ·0000001 of the distance of the North Pole from the Equator, measured on the meridian of Paris; its length is 39·37079 inches; and from it all the other weights and measures are derived

The Greek prefixes, *deca*, *hecto*, *kilo* and *myria*, are used to indicate decimal multiplication of the metre; and the Latin prefixes *deci*, *centi*, *milli*, to indicate decimal subdivisions of the metre. Thus: LENGTH.

Myriametre	=	393707·9	Inches.
Kilometre	=	39370·79	
Hectometre	=	3937·079	
Decametre	=	393·7079	
METRE	=	39·37079	
Decimetre	=	3·937079	
Centimetre	=	·3937079	
Millimetre	=	·03937079	

SURFACE. The unit of Surface is a decametre square, and is called the ARE (= ·02471143 acres).

10000 square metres	= 1 hectare	= 2·471143	acres.
100 „ metres	= 1 ARE	= ·02471143	„
1 „ metre	= 1 centiare	= ·0002471143	„

SOLIDITY. The unit of Solidity is a cubic metre, and is called a STERE (= 35·32 cubic feet).

CAPACITY. The unit of Capacity is a cubic decimetre, and is called a LITRE (= ·22009687 imperial gallons).

Kilolitre	=	220·09687	Gallons.
Hectolitre	=	22·009687	
Decalitre	=	2·2009687	
LITRE	=	·22009687	
Decilitre	=	·022009687	
Centilitre	=	·0022009687	
Millilitre	=	·00022009687	

WEIGHT. The unit of weight is a cubic centimetre of distilled water at its maximum density (very nearly 40° F.), and is called 1 GRAMME = ·00220462 lbs. av., 15·4323487 grains.

Ton or Millier	=	2204·62 lbs. av. = ·9842 tons.	
Quintal	=	220·462	lbs. av.
Myriagramme	=	22·0462	
Kilogramme	=	2·20462	

Hectogramme	=	1543·23487	grains.
Decagramme	=	154·32349	
GRAMME	=	15·43235	
Decigramme.....	=	1·54323	
Centigramme	=	·15432	
Milligramme	=	·01543	

MONEY. 5 grammes of silver of a certain fixed fineness are coined into 1 FRANC = 10 decimes = 100 centimes = $9\frac{1}{2}$ pence* nearly. (In familiar language, the decime is called *deux sous*).

INTERNATIONAL CALCULATIONS.†

a. Length.

	Multiply by:	or Divide by:
To turn yards into metres	·9143862	1·09363
" " Prussian ells	1·371	·7294
" " Austrian ells	1·1743	·8516
" " Spanish varas.....	1·0784	·9273
" " Portuguese varas ...	·8318	1·2022
" " Russian arsheens ...	1·2857	·7
" miles into kilometres	1·609315	·6213824
" " Prussian miles	·21364	4·6807
" " Austrian miles	·21212	4·7142
" " Spanish leagues	·23723	4·2152
" " Portuguese miles ...	·7821	1·2786
" " Russian versts	1·50852	·6629

b. Surface.

To turn sq. yds. into centiares (sq. metres)	·83612	1·196
" acres into hectares	·404671	2·471143
" " Prussian morgen ...	1·5848	·631
" " Austrian joch.....	·70308	1·4223
" " Portuguese geiras ...	·69187	1·4453

c. Capacity.

To turn gallons into litres	4·54345	·220097
" " Prussian eimer	·06614	15·118
" " Austrian eimer	·08027	12·4572
" " Spanish cantaros ...	·28264	3·538

* £1 sterling at par = fr. 25·2215.

† These calculations are mainly based on Woodhouse's Measures, Weights and Moneys of all Nations.

	Multiply by:	or Divide by:
To turn bushels into hectolitres	·363476	2·751211
„ „ Austrian metzen ...	·15762	6·3442
„ „ American bushels...	1·03152	·96944
„ quarters into Russian chetverts ...	1·3863	·7213
d. Weight.		
To turn lbs. av. into lbs. troy	1·21527	·82285714
„ grains into grammes	·06479895	15·4323487
„ lbs. av. into kilogrammes	·45359265	2·2046212
„ „ Prussian pounds ...	·96983	1·0311
„ „ Austrian pounds ...	·80959	1·2352
„ „ Spanish pounds.....	·9858	1·0144
„ „ Portuguese pounds..	·98828	1·01186
„ „ Russian pounds.....	1·10786	·90264
„ cwts. into quintals (metric) ...	·508023765	1·9684118
„ „ Prussian zentner ...	·987428	1·012732
„ „ Austrian zentner ...	·90674	1·102857
„ „ Portuguese quintals.	·864745	1·1564107
„ „ Spanish quintals ...	1·10414	·90571
„ „ Russian berkowitz...	3·102	·32237
„ tons into French tons (milliers)	1·01604753	·9842059
„ „ Russian packen	2·068008	·483557

For ordinary purposes francs are valued at 25 per £, which leads to easy calculations.

The following are ratios compounded on the Metric System, the money being calculated *at par* (fr. 25·2215 = £1), i.e., according to the intrinsic value of the coins.

e. To find in one operation the price in pound sterling:

				Multiply by:	or Divide by:
Per yard, given price per metre in francs				·03625	27·5862
„ sq. yard,	„	sq. metre	„	·03315	30·1649
„ acre,	„	hectare	„	·016044	62·3275
„ gallon,	„	litre	„	·1765735	5·66335
„ bushel,	„	hectolitre	„	·0144113	69·3897
„ lb. av.,	„	kilog	„	·01798432	55·6038536
„ cwt.,	„	quintal	„	·020142488	49·646298
„ *ton,*	„	millier	„	·040282976	24·823149